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A Programmatic Approach To Determine Eligibility of Prehistoric Sites in the San Diego Subregion, Southern Coast Archeological Region, California, for the National Register of Historic Places

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August 2007



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Register of Historic Places**

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Final Report

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Abstract: This report presents the thematic landscape approach that will be taken to prepare the regional prehistoric context for the San Diego Subregion of the Southern Coast Archeological Region (SDSSCAR). The goal of this project was to research and develop a regional, archeologically based, historic context that will facilitate a programmatic approach to determining National Register of Historic Places (NRHP) eligibility for archeological sites at a subset of Navy Region Southwest and Marine Corps installations. The cultural resource research questions to be addressed by this project are those common to pre/protohistoric archeological sites of the SDSSCAR. This work identified gaps in the current body of knowledge, and serves as a foundation for addressing these deficiencies and as a resource to aid in determining NRHP significance, assessing effects, and creating innovative management/treatment plans at the regional level. The study identified and evaluated a variety of classes of archeological sites and other types of cultural resources that characterize distinct landscapes in the SDSSCAR. The outlined approach will significantly decrease the number of individual, case-by-case undertakings, facilitate a more effective management process, and contribute to a better collective understanding of the precontact (prior to A.D. 1769) Native American regional perspective.

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Preface

This study was conducted for the Department of Defense (DOD) Legacy Resource Management Program under Project 05-251, via DACA42-02-D-0012. The technical monitor was Hillori Schenker, LRMP.

The work was managed and executed by the Land and Heritage Conservation Branch (CN-C) of the Installations Division (CN), Construction Engineering Research Laboratory (CERL). The CERL principal investigator was Tad Britt. This work was partly done Seetha N. Reddy, Statistical Research, Inc, Woodland, CA. As of this publication, Michael DeNight was the Acting Chief, CEERD-CN-C, and Dr. John T. Bandy Chief, CEERD-CN. The associated Technical Director was Dr. William D. Severinghaus, CEERD-CV-T. The Director of ERDC-CERL was Dr. Ilker R. Adiguzel.

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Department of Defense Legacy Resource Management Program

PROJECT 05-251

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May 2007

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Seetha N. Reddy

1 Introduction

1.1 Background

This report presents the thematic landscape approach that will be taken to prepare the regional prehistoric context for the San Diego Subregion of the Southern Coast Archeological Region (SDSSCAR) (Figure 1). The goal of this project is to research and develop a regional, archeologically based, historic context that will facilitate a programmatic approach to determining National Register of Historic Places (NRHP) eligibility for archeological sites at a subset of Navy Region Southwest and Marine Corps installations. The cultural resource research questions to be addressed by this project are those common to pre/protohistoric archeological sites of the SDSSCAR. This report identifies gaps in the current body of knowledge; it also serves as a foundation for addressing these deficiencies and as a resource to aid in determining NRHP significance, assessing effects, and creating innovative management/treatment plans at the regional level. A necessary goal of the study will be to identify and evaluate a variety of classes of archeological sites and other types of cultural resources that characterize distinct landscapes in the SDSSCAR. Such an approach will significantly decrease the number of individual, case-by-case undertakings; facilitate a more effective management process; and contribute to a better collective understanding of the precontact (prior to A.D. 1769) Native American regional perspective.

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Currently, each Navy Region Southwest and Marine Corps installation follows an Integrated Cultural Resources Management Plan (ICRMP). These documents are excellent for installation-specific issues. However, most precontact cultural issues extend beyond the fence lines of most installations, and no comprehensive DoD-focused plans have been implemented to address these regional themes. This project will address these geocultural issues and demonstrate an innovative, programmatic approach to Navy Region Southwest and Marine Corps cultural resource management (CRM) practices.

Given that this project offers a regional, contextual approach to CRM issues, it has the potential to guide the development of installation-specific research designs, to allow the Navy and Marine Corps to programmatically, and to address precontact Native American cultural resources increase our understanding of Native American land use, and facilitate Native American consultation efforts.

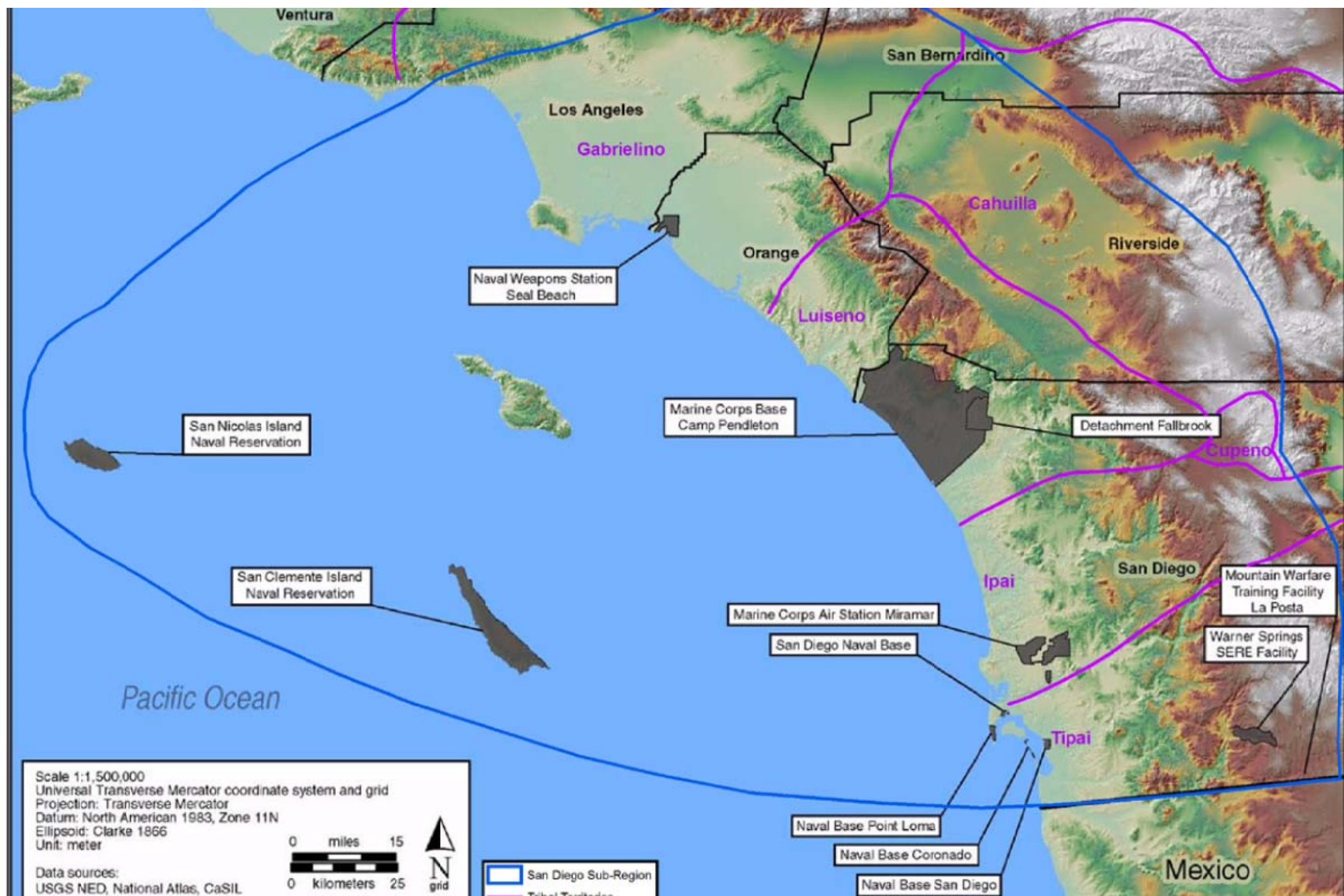


Figure 1. Project area depicting DoD installations, the San Diego Subregion of the Southern Coast Archeological Region (Moratto 1984 modified by Yatsko 2005), and Native American cultural territories (Heizer 1978).

As a result of developing and implementing this product, significant savings in time, money, and effort will be realized by the Navy and Marine Corps, the California Office of Historic Preservation, Native American groups, and other interested parties, such as other Federal agencies (e.g., the U.S. Forest Service, the Bureau of Land Management, and the DoD), and the City and County of San Diego. The initial goal of the project was to aid these consulting parties in identifying, evaluating, and developing treatment plans for a variety of classes of archeological sites and other types of cultural resources. This study revealed that a regional research design that encompasses San Clemente Island, San Nicolas Island, and coastal southern California is not a feasible endeavor given the current data. However, the ultimate goal of an integrated research design that crosscuts the SDSSCAR, is eventually achievable with additional research—specifically, the completing of an adequate inventory, the development of a definition of an archeological site that crosscuts installations, the development of a similar and consistent set of site types that also crosscuts the installations, and a definition of how to establish representative reserves of sites within each landscape that is consistent with stewardship responsibilities as outlined in Section 110 of the National Historic Preservation Act (NHPA).

1.2 A Landscape Approach

Table 1 lists the military installations considered in this study, along with their locations and their command structure. These 10 installations, located in seven commanding bases, are scattered across a varied geotopographical region that includes the Channel Islands, the southern California mainland coast, and mainland inland areas. Given the high variation in geotopographic and environmental settings among the 10 installations, a regional landscape approach is the most effective for constructing a thematic research design that is applicable to all the regions.

Landscape archeology is an increasingly prominent and recurrent avenue of research. Although landscape archeology as a theoretical orientation is recent, archeologists have always been interested in ancient landscapes and how they relate to the concepts of cultural continuity and change across space. Landscape archeology addresses the complex processes through which humans have, consciously and unconsciously, shaped the land around them (Bender 1993). Through time, humans have used various processes to alter the landscape for subsistence, economic, social, political, and religious purposes. In this perspective, landscape archeology strives to address how landscapes have shaped prehistoric cultural behaviors, both at a conscious and unconscious level (Knapp and Ashmore 1999). Alternatively, and of equal interest, is how cultures have shaped landscapes—in particular, how cultural responses and behaviors vary across landscapes and what the determining factors are.

Table 1. Military installations considered in the study, by commanding base.

Installation, by Commanding Base	County	Hereinafter Referred to As
Marine Corps Air Station Miramar	San Diego	MCAS Miramar
Marine Corps Base Camp Pendleton	San Diego	Camp Pendleton

Installation, by Commanding Base	County	Hereinafter Referred to As
Naval Base Coronado ^a		NB Coronado
Mountain Warfare Training Facility La Posta	San Diego	MWTF
San Clemente Island	Los Angeles	San Clemente Island
Warner Springs Survival, Evasion, Resistance, and Escape Facility	San Diego	SERE
Naval Base Point Loma	San Diego	NB Point Loma
Naval Base San Diego	San Diego	NB San Diego
Naval Base Ventura County ^a	Ventura	NB Ventura County
San Nicolas Island	Ventura	San Nicolas Island
Naval Weapons Station Seal Beach	Orange	NWS Seal Beach
Detachment Fallbrook	San Diego	Detachment Fallbrook
^a Not included in the 10 installations under consideration in this report.		

At its foundation, landscape archeology is a holistic approach to anthropogenic settings through regional archeological study rather than site-specific archeology. Landscapes are perceived and shaped through symbolic and social processes that are guided by cultural views of ownership, memory, history, legends, religion, and other factors (Bradley 1997). Thus, there can be ritual, sacred, and conceptual landscapes. Landscape archeology provides tools to examine these processes and thereby provide insights into past landscapes. Landscape archeology can be viewed as a theoretical orientation with an associated methodology that studies prehistoric material traces within the context of regional social interactions and a particular environment. What constitutes a landscape depends on the particular research project. It could be a large area with several micro- and macroeconomics or a small, restricted geographic unit. The primary distinction between landscape archeology and site-specific archeology is that the former emphasizes the relationship between the archeological data, cultural phenomena, and the regional environmental and cultural setting (Cherry et al. 1991).

Although a landscape approach to archeological practice provides a distinctive regional perspective, it also presents unique challenges. The most often discussed challenge is the concept of what constitutes an archeological site. In a landscape approach, individual sites become less important, and site boundaries are also relatively unimportant; instead, patterns in the use of landscape are of primary concern, and the areas between sites are of special and equal interest (Cherry et al. 1991).

Past patterns of use often leave distinct signatures, which have to be delineated for archeological interpretations. In this situation, some landscape approaches have explicitly focused on monuments such as landscapes of medieval town boundaries, historical structures, and historical gardens rather than ephemeral traces of human activities (Tilley 1994).

1.3 Categorization of the Study Area

To prepare a thematic landscape-based prehistoric (pre–A.D.1769) cultural context document, it is necessary to categorize the installations in the SDSSCAR. The basic geocultural groups within the SDSSCAR include the mainland and the island cultures. Using ecology and environmental setting as the determining factors, four landscape categories were defined among the 10 installations within the SDSSCAR (Table 2). The four landscape categories include: (1) southern Channel Islands, (2) sandy and lagoonal mainland coast, (3) rocky mainland coast, and (4) mainland inland highlands.

The southern Channel Islands include the San Clemente Island Range Complex (SCIRC), which is owned and operated by the U.S. Navy and administered by the Naval Air Station, North Island (NASNI), and San Nicolas Island, which is also owned and operated by the U.S. Navy and administered by Naval Base (NB) Ventura County. San Clemente and San Nicolas Islands are part of the southern Channel Islands and are widely classified as secondary islands with little ecological diversity. They share many similarities in environmental niches and landscapes and, therefore, are categorized into one type of landscape.

The mainland within the SDSSCAR has been divided into three distinct landscapes: sandy and lagoonal coast, rocky coast, and the inland highlands. The sandy and lagoonal mainland coast landscape includes long stretches of sandy beaches, which are framed by flat, raised Pleistocene terraces dissected by drainages. These landscapes are often associated with coastal lagoons. The coastal floodplains have deep alluvial deposits. This landscape characterizes the western portion of Camp Pendleton, much of Naval Weapons Station (NWS) Seal Beach, and NB San Diego. The Pleistocene terraces often continue inland where they abut the highlands. This landscape has rich and diverse resources, including littoral marine invertebrates, nearshore vertebrates, and plant and animal resources associated with lagoonal and terrestrial niches.

Table 2. Landscape categories for military installations in the study area.

Installation	Island	Mainland		
	Southern Channel Islands	Sandy and Lagoonal Coast	Rocky Coast	Inland Highlands
Camp Pendleton		X		X
Detachment Fallbrook				X
MCAS Miramar				X
MWTF				X
NB Point Loma			X	
NB San Diego		X		
NWS Seal Beach		X		
San Clemente Island	X			
San Nicolas Island	X			
SERE				X

The rocky mainland coast includes narrow strips of rocky shoreline with adjacent coastal Pleistocene terraces. The only example of rocky mainland coast landscape in the SDSSCAR is Point Loma, which is a north-south trending landform with east-west oriented, erosion cut channels. It is a peninsula that separates San Diego Bay from the Pacific Ocean. Point Loma terrain is hilly with flat areas that are confined to the margins of the shoreline. These flat areas are composed of poorly consolidated fossiliferous sandstone (Kennedy 1975).

The mainland inland highlands extend up to 100 km (62 mi) inland east of the coast and reach elevations of up to 975 m above mean sea level (AMSL) (3,199 ft AMSL). This landscape includes both upland areas and the valleys between them. It hosts oak woodlands and oak grasslands with drainages of varying sizes. The valleys have rich alluvial sediments and, in some cases, riparian habitat. In this study, five of the ten installations are in this mainland inland highlands landscape category: the Warner Springs Survival, Evasion, Resistance, and Escape Facility (SERE), Mountain Warfare Training Facility La Posta (MWTF), Detachment Fallbrook, Marine Corps Air Station (MCAS) Miramar and the Marine Corps Base Camp Pendleton (Camp Pendleton) highlands.

For this study, specific installations representing the four different landscapes were selected for consideration, and these installations will be used as examples for each landscape category. Although both islands will be considered, all the installations on the mainland will not be discussed; instead, comparative examples will be used. NB Point Loma will be used to represent the rocky mainland coast landscape, because it is the only installation in this landscape category. Camp Pendleton will be used to characterize sandy and lagoonal mainland coast and mainland inland highlands. The sandy and lagoonal mainland coast landscape of Camp Pendleton will be applied to NB San Diego and NWS Seal Beach, and the mainland inland highlands landscape of Camp Pendleton will be applied to SERE, MWTF, Detachment Fallbrook, and MCAS Miramar.

Camp Pendleton was specifically selected to represent the sandy and lagoonal mainland coast and mainland inland highlands because of its large size (125,547 acres). In addition, it has been the venue of extensive and intensive archeological investigations in the past decade, which have included synthetic overviews, surveys, and excavations (e.g., Byrd and Berryman 2006; Reddy and Berryman 1999). As such, it is possibly the only region in coastal southern California that has landscapes from the coast to the inland highlands with substantial archeological data. For example, recent archeological publications on the sandy and lagoonal mainland coast landscape of Camp Pendleton by Brewster et al. (2003), Byrd and Reddy (1999, 2002), Reddy (1999, 2004, 2005), Reddy and Brewster (1999), and Waters et al. (1999) have generated scholarly debate on the interpretation of how this landscape was used in the past (Byrd 1998; Rosenthal et al. 2001). Similarly extensive research in the inland highlands on the base has provided valuable insight regarding late Holocene adaptations in these landscapes (Hale and Becker 2005; Reddy 1997a, 2000; York et al. 1999). Consequently, Camp Pendleton is ideal to use as an example of the landscapes found on the

1.4 Outline of the Report

The report has six chapters, including this introductory chapter. The project setting and a summary of the environment, geotopography, and paleoenvironment of each of the landscape types are presented in Chapter 2. Chapter 3 presents a synthetic summary of the temporal scale and interpretations of the prehistoric human adaptations in the four landscape categories. Major research issues relevant to the study and the study area are discussed in Chapter 4. The subsequent chapter presents relevant project design, approach and methods toward site categorization within each landscape category. Finally, Chapter 6 discusses management issues, including the recommended approach to the Section 106 process using the landscape approach.

2 Project Setting Overview

2.1 Setting

This chapter of the report presents a broad overview of the project setting, with particular reference to the four landscape categories identified in the study area. The discussion of each landscape includes paleoenvironmental reconstruction, location, geotopography, and environment. In the paleoenvironmental discussion, our current understanding of the paleoenvironment based on recent reconstructions is summarized. Postglacial environmental changes have influenced changes in sea level, littoral habitats, the nature of the intertidal zone, and alleviation of coastal plains, which, in turn, significantly shape habitats and their associated biomass. The structure of the paleocoast was determined by climate, plate tectonics, and changes in sea level. For example, the estuarine development and disintegration in the general coastal southern California region are directly associated with postglacial environmental sea level changes. Subsequently, the location, geotopography, and environment are discussed for each landscape category. This is not intended to be an exhaustive summary, but a review of the major salient features of the settings as relevant to the research issues that will be identified and discussed in the document.

2.2 Islands

The two islands in this project, San Nicolas and San Clemente, are both southern Channel Islands. The settings of the islands are similar, with some unique distinctions. Consequently, the paleoenvironmental reconstruction is presented as a synthetic discussion of both, whereas the location and environmental summary is separate for each. In addition, a short discussion of Catalina Island's location and environmental setting is presented, in consideration of its close proximity to San Nicolas and San Clemente Islands.

2.2.1 Paleoenvironmental Reconstruction of the San Nicolas and San Clemente Islands

Channel Islands researchers recognize that two paleoenvironmental forces played a significant role in prehistoric cultural adaptations on the islands: sea temperature and late Holocene climatic flux. An important unresolved issue, related to the changing paleotemperature and climate, is whether periods of elevated sea temperatures during the Holocene had any measurable effect on the reduced marine subsistence yields.

Palynological, oxygen isotope, and tree ring data have revealed dramatic changes in the paleoenvironment of southern California over the past 10,000 years. Sediment cores from the Santa Barbara Basin contain a predominance of pine (*Pinus* spp.) in samples dated between 10,000 and 8,000 years ago, suggesting that this was a time of cool and moist climatic conditions (Heusser 1978). Around 8,000

years ago, oak (*Quercus*) and sun flower (Asteraceae) communities began to thrive, indicating a climatic shift to warmer and drier conditions (Heusser 1978; Pisias 1978). This period, known as the Altithermal, lasted until approximately 5,000 years ago (Antevs 1955). During this time, sea levels rose rapidly, resulting in dramatic changes in southern California terrestrial and marine environments.

Research on paleoclimatic change using temperature-sensitive radiolarian assemblages in sea cores from the Santa Barbara Basin (Pisias 1978, 1979) and San Joaquin Marsh (Davies 1992) has demonstrated that changes in sea surface temperature has a dramatic effect on the productivity of marine ecosystems. Oxygen isotopic (^{18}O) analysis of sea floor cores reveals elevated sea surface temperatures between 3800–3600 B.P. and 1800–800 B.P. (Pisias 1978). Such changes in sea surface temperature (high or low) are destructive to kelp beds, which are home to many resources important to prehistoric coastal populations. In particular, Colten (1992) and Arnold (1992, 1995) have argued that elevated sea surface temperatures between A.D. 1100 and 1330 had a devastating impact on maritime subsistence. Larson and Michaelson (1989) used tree ring data to argue that between A.D. 1100 and 1250 the climate was very harsh. Subsequently, using radiocarbon dates from drowned trees in Sierra Nevada lakes, streams, and marshes, Stine (1994) made similar observations of climatic deterioration first between A.D. 892 and 1121, then between A.D. 1209 and 1350. These events of drought, lowest moisture levels and increased sea surface temperatures all correspond. Furthermore, analysis of pollen from a sediment core taken from Twin Rivers Marsh on San Nicolas Island provides additional evidence of warm conditions during this time, particularly between 1375 and 1250 B.P. (Davis et al. 2003). The same sediment core contained foraminifera, indicating that sea levels rose between approximately 1250 and 920 B.P. (Davis et al. 2003). Following this period was an interval of cold and unstable sea surface temperatures in the Santa Barbara Basin that lasted until approximately 700 B.P. (Kennett and Kennett 2000). The Twin Rivers Marsh sediment core contains concentrations of arboreal pollen (pine, oak, and *Ceanothus*) suggesting wet conditions on San Nicolas Island during this time (Davis et al. 2003). Minimal concentrations of charcoal in the sediment core and the absence of exotic pollen between 920 and 420 B.P. suggest that San Nicolas Island was largely abandoned during this time (Davis et al. 2003).

Climatic conditions on San Nicolas Island appear to have been wetter and cooler between 420 and 210 B.P. (Davis et al. 2003). Concentrations of exotic pollen suggest the island was more intensively used during this time. More mesic conditions and increased human activity during this period appear to be common trends throughout many parts of southern California (Davis 1992; Larson and Michaelson 1989; Michaelson et al. 1987; Raab and Larson 1997).

Archeological research on San Clemente Island has, however, called some of these paleoclimate models into question (Raab, Bradford, Porcasi, and Howard 1995). Prehistoric sites on San Clemente Island (the Eel Point site, CA-SCLI-43) and Santa Catalina Island (the Little Harbor site) have diverse marine resources (shellfish, fish, and mammals), which were exploited at times with elevated sea

surface temperatures. These archeological findings contradict the marine paleo-climate/temperature model.

2.2.2 San Nicolas Island Location and Geotopography

San Nicolas is the most remote of the Channel Islands. The island is situated approximately 120 km southwest of Los Angeles, and its nearest neighbor, Santa Barbara Island, is located approximately 45 km to the northeast. Compared to San Clemente Island, San Nicolas Island is relatively small, measuring 15 km long, 6 km wide, and roughly 280 m AMSL (Swanson 1993) (Figure 2).

Reinman and Lauter (1984) divide San Nicolas Island into four topographic zones: the central plateau, northern coastal terrace, southeast coastal terrace, and eastern cliffs. The center of the island consists of a windswept plateau covered with eroded sand dunes. Bordering the plateau to the north, the coastal terrace is made up of stabilized and shifting sand dunes, wave cut cliffs, and sandy terraces. Compared to the island's northern reaches, the southern and eastern coasts are relatively rugged. The south coast is marked by heavily eroded hills, whereas the east coast is made up of steep cliffs. Although remnants of human occupation are observed within all four topographic zones, the northern coastal terrace appears to have been a favored location, as evidenced by the huge complex of archeological sites identified in this area. The island's diverse environment has supported human populations for at least 8,000 years.

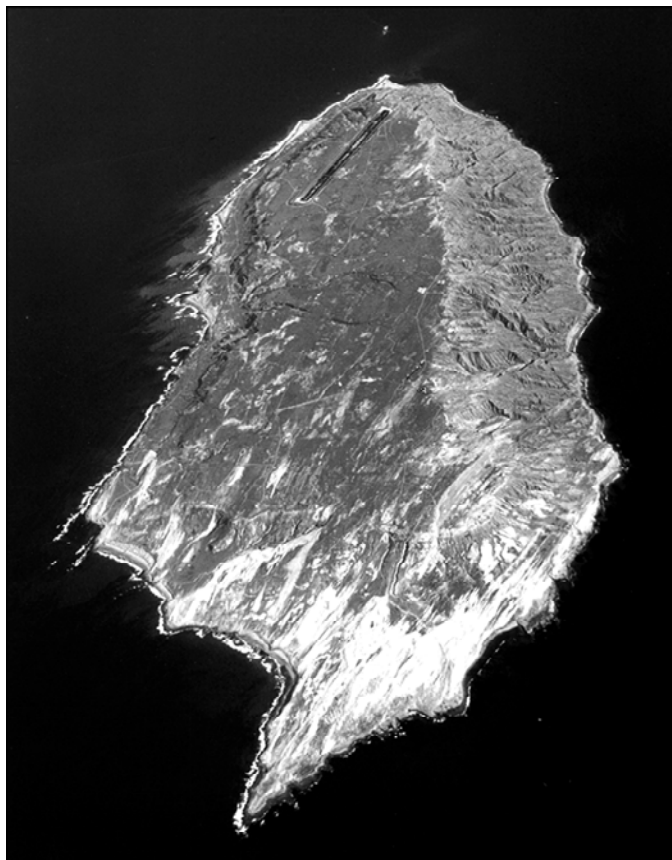


Figure 2. San Nicolas Island (photograph courtesy of U.S. Navy).

On San Nicolas Island, fresh water originates from precipitation that is absorbed by sand dunes and retained in the underlying bedrock and marine terrace water-bearing deposits (Burnham et al. 1963). Potable water is available in the form of perennial springs and seeps, located primarily in the northwest portion of the island. A few smaller sources are found along the south coast as well.

Twelve perennial springs or seeps were identified within the western portion of the island during an island wide hydrology reconnaissance (Burnham et al. 1963). During his archeological survey of the island, Woodward (1939) noted two perennial lakes situated on the island's central plateau. Fresh water is available even in drought years; however, it tends to be less abundant and often brackish (Vellanoweth et al. 2002).

More than half of the island is made up of Quaternary sedimentary deposits comprised of sand dunes, marine terrace deposits, beach sand, alluvium, colluvium, and other residual soils (Vedder and Norris 1963). Sandy beaches are particularly abundant on San Nicolas Island, comprising approximately 33 percent of total beach area for all of the Channel Islands (Engle 1994).

San Nicolas Island's bedrock is primarily composed of Eocene age sedimentary rock that extends at least 1,524 m (5,000 ft) below the ground, forming a series of complex folds and faulted anticlines. This bedrock is made up of four principal rock types: thick bedded sandstone, thin bedded sandstone, thinly interbedded sandstone and siltstone, and metavolcanic and metasedimentary pebbles and cobbles. Early islanders primarily used metavolcanic cobbles for stone tool production, including varieties composed of varying degrees of inclusions (e.g., porphyritic metavolcanic and metavolcanic porphyry) and metasedimentary rocks. A survey of the island has revealed nine conglomerate beds where these raw materials were likely quarried (Clevenger 1982).

Outcrops of high quality sandstone were another source of toolstone material. Islanders readily quarried naturally occurring bulbous formations to produce a variety of ground stone implements, including bowls, mortars, and pestles. The magnitude of production and excellent craftsmanship suggest these implements were not only used locally, but traded with other island and mainland groups (Bryan 1970; Heizer 1951; Schumacher 1877).

2.2.3 San Nicolas Island Environment

San Nicolas Island, an arid environment, receives approximately 20 cm of precipitation annually, mostly derived from fog. Fresh water is available from springs and seeps; however, there are no permanent streams on the island. Overall, the island supports limited terrestrial resources. Island vegetation is limited primarily to shrubs and grasses. Of the 270 plant species recorded on the island, over half are introduced species, the result of sheep grazing during the early to middle twentieth century. Vegetation consists primarily of coastal strand and sanddune plant communities and includes silver lupine (*Lupinus albifrons*) associated with dune malacothix (*Malacothix incana*), silver lotus (*Lotus agrophyllus*), coastal goldenbush or happlopappus (*Isocoma menziesi*), ice plant (*Tetrago-*

nia sp.), beach primrose (*Cammissonia cheiranthifolia*), verbena (*Abronia umbellata*), silver beach weed (*Ambrosia chamissonis*), and locoweed (*Astragalus traskiae*) (Foreman 1967).

San Nicolas Island supports few vertebrate terrestrial fauna, which are limited to island foxes (*Urocyon littoralis*), white-footed deer mice (*Peromyscus* sp.), and island night lizards (*Xantusia riversiana*). These species were likely introduced during prehistoric times, whereas more recent arrivals include the southern alligator lizard (*Elgaria multicarinata*) and side blotched lizard (*Uta stansburiana*). Other recent introductions include a small population of burrowing owls (*Athene cunicularia*).

In contrast to the limited terrestrial resources, marine life surrounding the island is abundant and diverse. The California Current bathes San Nicolas Island in cold, highly oxygenated waters from northern subarctic regions (Engle 1994). Offshore kelp beds thrive in these nutrient rich waters. In fact, San Nicolas Island kelp forests comprise more than 30 percent of the total kelp forest area for all eight Channel Islands (Engle 1994). Fish commonly found in the kelp forests include rockfish (*Sebastes* spp.) and California sheephead (*Semicossyphus pulcher*) in addition to hard bottom feeders such as cabezon (*Scorpaenichthys marmoratus*) and sandy bottom feeders like surfperch (*Embiotocidae*). Sea otters (*Enhydra lutris*) were once common in the kelp forests and fed on sea urchin (*Strongylocentrotus* spp.). Otter populations were virtually extirpated in the late nineteenth and early twentieth centuries following intensive fur hunting, but their numbers are increasing as a result of current conservation efforts. Pacific white sided dolphins (*Lagenorhynchus obliquidens*) and whales (*Cetacea*) occasionally visit the area.

Closer to shore, a variety of shellfish inhabit the island's offshore reaches including several species of abalone (*Haliotis cracherodii* and *H. rufescens*), California mussel (*Mytilus californianus*), wavy topshell (*Astraea undosa*), limpets (*Megathura crenulata*, *Lottia* spp., and *Acmaea mitra*), chitons (*Mopalia ciliata* and *Cryptochiton stelleri*), Norris top shell (*Norrisia norrisi*), and turbans (*Tegula* spp.). In the past, islanders collected olive shells (*Olivella* spp.) and used them to manufacture a variety of styles of shell beads. Early islanders also collected sea grass (*Phyllospadix scouleri* and *P. torreyi*) growing in shallow waters to produce cordage, textiles, and woven baskets (Thomas 1995).

A variety of birds feed in the offshore waters and breed on the island, including snowy plovers (*Charadrius alexandrinus*), black oystercatchers (*Haematopus bachmani*), Brandt's cormorants (*Phalacrocorax penicillatus*), western gulls (*Larus occidentalis*), brown pelicans (*Pelecanus occidentalis*), American kestrels (*Falco sparverius*), and various ducks (Anatidae). Red-tailed hawks (*Buteo jamaicensis*) are occasionally spotted. The island and offshore waters also support six species of pinnipeds, including California sea lions (*Zalophus californianus*), northern elephant seals (*Mirounga angustirostris*), and Pacific harbor seals (*Phoca vitulina*).

2.2.4 San Clemente Island Location and Geotopography

San Clemente Island is the southernmost of the four southern Channel Islands and is approximately 76.8 km (48 mi) from the nearest landform on the mainland, 102 km (about 55 nautical miles [nm]) south of Long Beach, and 126 km (about 68 nm) west of San Diego (Figure 3). The island is approximately 38.9 km (21 nm) long and 8.3 km (4 1/2 nm) across at its widest point; the total land area is about 148.5 km² (57 sq mi). Since 1934, the island has been owned and operated by various naval commands. NASNI is responsible for its administration.

Geologically, the island is of Miocene origin and consists of volcanic rock and sedimentary deposits. The island was formed by being thrust above the ocean by block faulting, and this process, in concert with the rising and lowering sea levels during the Pleistocene, has formed at least 18 wave cut terraces on the west shore (Olmstead 1958). This unique landscape has been subject to active erosion, producing a broad, rocky shelf that characterizes much of the island. The volcanic island has dune sands, alluvial fans, and marine terrace deposits.

San Clemente Island has an arid environment and maritime climate. The annual precipitation varies from 13 to 20 cm (5–8 in.), resulting primarily from winter storms, and the annual average humidity is 80 percent. Fresh water is available from springs and seeps, especially in the canyons.



Figure 3. San Clemente Island (photograph courtesy of the U.S. Navy).

Most of the island's coastline is rugged and precipitous, especially on the eastern coast—the western side has wider terraces leading to the highlands. Sandy beaches are uncommon, and the largest beaches are found at the southern end of the island. The island consists of central grassland mesas and interspersed, steep, tree lined canyons; precipitous eastern escarpments; and gently sloping, western wave formed marine terraces.

Yatsko (1990) and Raab and Yatsko (1998) have identified six major topographic zones on the island that have played an important role in cultural adaptations: Coastal Terrace, Upland Marine Terraces, Sand Dunes, Plateau, Eastern Escarpment, and Major Canyons. The Coastal Terrace starts at sea level and reaches 30 m AMSL; it is continuous on the northern, western, and southern coastlines. This topographic zone has the highest density of sites, all of which are shell bearing middens of varying sizes.

The Upland Marine Terraces are located on the western side of the island, start at 30 m AMSL, and reach between 120 and 275 m AMSL, depending on whether the terraces are on the north or south side of the island. This zone contains moderately high site density and includes a wider range of sites (shell middens, lithic scatters, and house pits). Sand Dunes are most common in the northern one-third of the island (south of the airfield) and have moderate to high densities of sites. The Plateau is the central spine of the island, with an elevation of 500 m AMSL at the highest point (Mount Thirst). It is a marked contrast to the Coastal Terrace in terms of elevation and physiography.

Raab and Yatsko (1998) suggest that the Plateau would have provided a view of Santa Catalina Island and perhaps would be a sighting spot for watercraft. Archaeological sites in the zone include small, deflated shell scatters, low density lithic scatters, and some expansive complex sites that were occupied in the middle Holocene.

The Eastern Escarpment encompasses the precipitous dissected locales along the eastern margin of the island with slope grades of 45–100 percent. It has the lowest site density, with the majority of the zone being too steep to be inhabitable. Canyons located along the escarpment would have hosted vegetation communities with valuable food resources (such as acorns). Coves (such as Wilson Cove) within this zone would have been shelters for launching and landing watercraft. In addition, some locations in this zone would have been good lithic quarrying locations (Howard 1991).

The Major Canyons are located on the southwestern slope and also dissect the Eastern Escarpment. The canyons create rugged terrain and host cactus stands; many canyons have natural water tanks, which hold considerable volumes of rainfall water. Rockshelters are found in this zone.

2.2.5 San Clemente Island Environment

San Clemente Island is a rich environment that includes marine and terrestrial ecozones. The coves around the island have abundant sea life, including sea lions,

lobsters, hydrocoral, and kelp forests. The island offers rocky intertidal habitats with shallow reef and kelp beds that support very rich marine ecosystems. As in the case of San Nicolas Island, highly oxygenated waters from northern subarctic regions host a rich habitat, including kelp beds. Some of the fish commonly found in the kelp forests include rockfish (*Sebastes* spp.) and California sheephead (*Semicossyphus pulcher*) in addition to hard bottom feeders such as cabezon (*Scorpaenichthys marmoratus*) and sandy bottom feeders like surfperch (Embiotocidae). Pacific white sided dolphins (*Lagenorhynchus obliquidens*) and whales (*Cetacea*) occasionally visit the area. In addition, the rocky shoreline of San Clemente Island hosts a variety of shellfish, including abalone (*Haliotis cracherodii* and *H. rufescens*), California mussel (*Mytilus californianus*), wavy topshell (*Astraea undosa*), limpets (*Megathura crenulata*, *Lottia* spp., and *Acmaea mitra*), chitons (*Mopalia ciliata* and *Cryptochiton stelleri*), Norris top shell (*Norrisia norrisi*), and turban shells (*Tegula* spp.).

Terrestrial mammals, which were important resources for prehistoric populations, include the island fox (*Urocyon littoralis*), an indigenous species, and the white footed deer mouse. As on San Nicolas Island, the range of terrestrial animals available is very limited, and the largest native mammal is the island fox, which is the size of a domestic house cat. Feral goats (San Clemente goat, a recognized breed of domestic goat) roamed the island for centuries, reaching a population of 11,000 in 1972, when their effect on indigenous species was realized. By 1980, the population had been reduced to 4,000. A plan for shooting remaining goats was blocked in court by the Fund for Animals, so the goats were removed with nets and helicopters. San Clemente Island has several endangered and protected plants and animals. Loggerhead shrike is an endangered species that the Navy is taking steps to protect.

The island flora includes eight major plant communities including Grassland, Maritime Succulent Scrub, Maritime Sage Scrub, Canyon Scrub/Woodland, Coastal Salt Marsh, Coastal Strand, Sand Dune and Sea Bluff Succulent (Yatsko 2000). The majority of the island is covered by Grassland and various Maritime Succulent Scrub plants. Historical period grazing by sheep and goats has destroyed the island vegetation. Trees and shrubs grow in isolated pockets; for example, oaks are present in a few isolated stands in deep canyons. Raab and Yatsko (1998) have suggested that, before the historical overgrazing and destruction of the vegetation, perennial woody vegetation may have been present on the Plateau and provided valuable resources for housing and food. Overall, the island's native flora is constrained in comparison to the mainland. Thus, marine resources were of more economical importance relative to terrestrial resources.

2.2.6 Catalina Island Location and Environmental Setting

Catalina Island, also known as Santa Catalina Island, is located approximately 36 km southwest of Los Angeles, California (see Figure 1). Most of this rocky island is owned by the Catalina Island Conservancy. It is one of the eight Channel Islands and the only one with a significant permanent civilian settlement—the city of Avalon. Part of Los Angeles County, it is also part of the southern Channel Is-

lands, which include San Nicolas, Santa Barbara, and San Clemente. Catalina is the third largest of the eight Channel Islands (Baker 2002).

Catalina Island is about 35 km long and 13 km wide at the widest point, with 87 km of coastline. About 10 km from the westernmost end, known as the West End, there are two opposing coves (Isthmus Cove and Catalina Harbor) that form a narrow neck of land called the Isthmus that is only 0.4 km wide. The island has very steep and rugged topography punctuated by sheltered coves and highland terraces. Catalina Island is marked by a semi Mediterranean climate moderated by coastal proximity.

Island flora is characterized by both endemic and introduced plants. Approximately 400 species of Island native plants grow on the island, six of which are endemic and found only on the island. These plants include Santa Catalina Island manzanita (*Arctostaphylos catalinae*), Catalina Island mountain mahogany (*Cercocarpus traskiae*), Catalina dudleya (*Dudleya hassei*), St. Catherine's lace (*Eriogonum giganteum* var. *giganteum*), Santa Catalina Island bedstraw (*Galium catalinense* ssp. *catalinense*), and the Catalina ironwood (*Lyonothamnus floribundus* ssp. *floribundus*) (Catalina Island Conservancy 2006). Scrub-oak stands are scattered through much of the central highlands.

The fauna on Catalina Island are a rich ensemble of marine and terrestrial animals. The most common marine fish include garibaldi, blacksmiths, and opal eyes. The animals native to Catalina Island include Catalina Island gray fox; small rodents such as mice, squirrels, and the ornate shrew; bats; six kinds of snakes (including the Pacific rattlesnake); lizards; and tree frogs. Several animals were introduced to the island in historical times. These include goats, bison, mule deer, wild boar, black buck antelope, and bullfrogs. The bald eagle was reintroduced to the island through the Institute for Wildlife Studies Bald Eagle Project.

2.3 Sandy and Lagoonal Mainland Coast

This landscape category includes long stretches of sandy beaches framed by flat, raised Pleistocene terraces dissected by drainages; often, the coastal strip has associated lagoons (Figures 4 and 5). As discussed in Chapter 1, this landscape characterizes the western portion of Camp Pendleton, much of NWS Seal Beach, and NB San Diego. Camp Pendleton will be used to characterize the sandy and lagoonal mainland coast landscape category and will be applied to NB San Diego and NWS Seal Beach.

2.3.1 Paleoenvironment

Paleoecological reconstruction of the mainland coast, particularly for the sandy and lagoonal mainland coast landscape, has profound implications for archeology. Based on sediment transport data and sea level changes, Inman (1983) presented seminal concepts on environments changing in response to rising sea levels and applied it to the coastal evolution of the Oceanside littoral cell in the northern part of San Diego County.



Figure 4. Sandy mainland coast (photograph courtesy of Mr. Stanley Berryman, Camp Pendleton).



Figure 5. Lagoon on mainland (photograph courtesy of Mary Beth Stowe).

The Camp Pendleton sandy and lagoonal mainland coast landscape is located within the Oceanside littoral cell, which extends from Dana Point in Orange County to La Jolla in San Diego and is today characterized by sandy beaches and cliff erosion. Inman (1983) and Curray (1965) have noted that the shoreline was significantly different in the past, starting at the onset of the Holocene with sea levels at least 30 m below present sea level (BPSL). The sea levels rose dramatically during the early Holocene; then, the rate of their rise slowed down noticeably in the last 4,000 years. Inman's (1983) model presents four stages of coastal evolution: formation of deeply cut valleys when sea levels fell (as they did at the last glacial maximum 20,000 years ago), formation of bays as these valleys were flooded when the sea levels rose, formation of salt marsh ecozones as the sea levels continued to rise, and ultimate inundation of the lagoons and transformation of rocky beaches to sandy beaches (Masters 1985). These paleoenvironmental changes are of critical importance in modeling, interpreting, and understanding the timing and pace of prehistoric human adaptations in the study area. In the discussion below, the paleoenvironmental background for each of the landscapes relevant to this project is presented, with the exception of the mainland inland highlands. The focus of the paleoenvironmental setting is on responses to changing sea levels in the Holocene, and it is not directly relevant to the mainland inland highland landscape.

In the early Holocene, rocky shorelines with small littoral cells and lagoons were created by the rapidly rising sea levels. As sea levels rose, these were replaced by stretches of sandy beaches, starting first at Dana point and moving southward to La Jolla. Localized geomorphological studies conducted on Camp Pendleton in the Las Flores Creek and Horno Canyon areas (Anderson 1996; Waters 1996a), Las Flores Lagoon (Byrd 2003; Reddy and Pope 2005), Lower Santa Margarita River (Pope 2005), and also at San Elijo Lagoon further to the south (Byrd et al. 2004) present models for the development of each of these watersheds along the sandy lagoonal coast on the mainland.

Geomorphological research by Anderson (1996) and Waters (1996a) along Las Flores Creek and in Horno Canyon and in the Las Flores Lagoon by Byrd (2003) and Reddy and Pope (2005) provides insight into the formation and evolution of these coastal drainage systems. In the latter part of the Holocene, both were actively forming alluvial deposits. Radiocarbon dating of Las Flores Creek deposits dates such deposition to at least 4000 B.P. Pollen and geomorphological studies have revealed vacillations in the second half of the Holocene, with periods of relatively stable land surfaces and periods of rapid sedimentation, e.g., Anderson (1996) documented considerable change in the local environment in the last 4,000 years; *Cypressus* type pollen recovered from the Las Flores erosion profile indicates much wetter conditions at the end of the middle Holocene.

Geomorphological coring in the lower Santa Margarita River valley by Byrd (2005) involved a paleoenvironmental study by Pope (2005) documenting a 10,000 year history of a postglacial marine transgression and regression. Starting in 20,000 B.P., the sea level rose from about -130 m (BPSL), and filled the deeply incised Santa Margarita River valley with alluvium. By 9500 B.P. (when sea level

was approximately –10 m BPSL), this rapid rise of sea level led to the flooding of the valley with estuarine sediments. Starting in about 5400 B.P. (when sea level was approximately –5 m BPSL) the slowing of sea level rise led to lagoonal silting, which eventually resulted in the burial of the lagoon and associated salt marsh environments under several meters of alluvium as the Santa Margarita River delta prograded seaward, resulting in the present configuration. Pollen studies of sediment by Davis (2005) from the same cores revealed freshwater plants between 7500 and 4500 B.P.; saltwater indicators abound between 6500 and 5000 B.P. Based on the geomorphology and pollen data, Byrd (2005) noted that the Ysidora basin was filled with saltwater (from the sea level rise) until 5000 B.P. and was ringed by extensive wetlands from 7500 to 4000 B.P.; then, tidal flats filled much of the lower Ysidora basin between 6500 and 5500 B.P.

Reconstruction of the paleoclimate by Pope (2005) reveals a distinct early Holocene period (9600 B.C.–5000 B.C.) with abundant ferns near the present coast in the Ysidora Flats area, which suggests intense coastal fog. Data documented that seasonality was more apparent in the early Holocene and late Holocene (1000 B.C.–present), and the middle Holocene (5000 B.C.–1000 B.C.) was much more stable. Pope (2005) and Reddy and Pope (2005) used geomorphological data from cores to reconstruct the formation of the Las Flores Lagoon and the San Elijo Lagoon.

In summary, geological data from the general coastal San Diego region supports Inman's (1983) model and affirms that rising sea levels in the late Pleistocene caused rapid aggradation of coastal streams and rivers and flooded larger coastal valleys by 7300 B.C. to form an extensive system of lagoons (Las Flores, Ysidora Flats, Batiquitos San Elijo, and La Jolla Canyon) (Byrd et al. 2004). The dates of the lagoons' formations, their longevity, and their ultimate infilling are not clear, but the latter took place after the drop in the rate of sea level rise after 4000 B.C. Geomorphological and archeological studies at Las Flores Lagoon (Reddy 2004), Batiquitos Lagoon (Gallegos 1985) and the San Elijo Lagoon (Byrd et al. 2004) all suggest that the infilling was a complex process, and the character and timing varied between the drainages. In addition, these studies illustrate that the paleo-coast had changed dramatically from a rocky coastline to sandy beaches by 4000 B.P. Further, climate was wetter and cooler in the early Holocene than it is now.

2.3.2 Location and Geotopography

The sandy and lagoonal mainland coast on Camp Pendleton lies within the Peninsular Ranges geomorphic province (Moratto 1984). This landscape category characterizes the western coastal strip of the base and the area extending approximately 28 km from San Clemente in Orange County to Oceanside in San Diego County. A series of drainages, from north to south, flow northeast to southwest into the ocean, including San Mateo Creek, San Onofre Creek, Horno Canyon, Las Flores Creek, and the Santa Margarita River. The landscape is comprised of rolling hills with a series of flat coastal terraces cut by drainages. The Pleistocene terraces often continue inland, where they abut the highlands. The coastal terraces were formed by coastal uplifting and are mostly Pleistocene marine and non-marine terrace materials with overlay Miocene and Tertiary deposits (Kern 1995;

Weber 1963). These coastal bluffs frame the sandy beach shoreline. The five drainages form distinct valleys, with San Mateo Creek and Santa Margarita River forming wide valleys with steep hills flanking both sides before reaching the ocean. In contrast, Las Flores and Horno Canyon are much narrower drainages that have cut into alluvial sediments.

2.3.3 Environment

Coastal northern San Diego County (where Camp Pendleton is located) has a Mediterranean, semiarid, cool steppe climate that has been moderated by the ocean (Hines 1991). The landscape has rich and diverse resources, including littoral marine invertebrates, nearshore vertebrates, and plant and animal resources associated with lagoonal and terrestrial niches. Major plant communities include coastal sage scrub, fresh and saltwater marsh, riparian plants, grasslands, and chaparral (Munz 1974). Vegetation mapping on the base has identified distinct plant groups along this coastal stretch, including Diegan coastal sage scrub, coastal sage/chaparral scrub, southern willow scrub, southern coastal bluff scrub, valley needle grass, nonnative grassland, *Ceanothus crassifolius* chaparral, chamise chaparral, southern mixed chaparral, sycamore/alder riparian woodland, southern cottonwood/willow riparian forest, San Diego Mesa hardpan vernal pool, coastal and valley freshwater marsh, coastal brackish marsh, southern coastal salt marsh and southern foredune (Pacific Southwest Biological Services 1986). Coastal scrub plant species common in the area are buckwheat, black sage, white sage, sugar bush, squaw bush, and laurel sumac. Riparian plants such as freshwater marsh plants (cattail, spikerush, and bulrush) and salt marsh plants (pickleweed, salt grass, and sea lavender) are common. Willow, cottonwood, and sycamore trees often line the riparian corridors.

Animals common in this landscape include small terrestrial mammals, birds, and reptiles indigenous to the region, including mice, bats, desert cottontail, California ground squirrel, desert wood rat, bobcat, coyote, and mule deer among others. Water fowl are common around the lagoons and include geese, ducks, and gull. A variety of marine resources are available including sandy and lagoonal habitat resources. *Donax gouldii* (bean clam) inhabit the sandy beaches in varying densities and have periodic population blooms (Reddy 1995). Shell fish such as *Argopectin*, *Chione*, *Ostrea*, and *Tagelus* are some of the lagoonal resources available. Marine mammals and fish available in the past are also readily available today.

2.4 Rocky Mainland Coast

The rocky mainland coast landscape category is characterized by narrow, rocky shorelines that are the habitats of plant and animal resources particularly adapted to these sediments. This landscape is often relatively dynamic and experiences unique ecological changes. For example, when the rocky coastline lies in the tidal zone, tidal pools are formed that offer an exceptional diversity of valuable rocky intertidal resources (Figure 6). Within the study area, the rocky mainland coast landscape is represented at NB Point Loma and is comprised of narrow strips of

rocky shoreline with adjacent coastal Pleistocene terraces. Point Loma is a north-south trending peninsular landform with east-west oriented, erosion cut channels that separates San Diego Bay from the Pacific Ocean.

2.4.1 Paleoenvironment of Point Loma

Master's (1998) synthesis of the paleocoast of the San Diego Bight with particular reference to Point Loma is summarized here. In 18,000 B.P., the sea level stood at 120 m BPSL, and Point Loma was a "massif rising behind relict stacks" (Masters 1998); the outer plain had little topographic relief, and the beaches were rocky.

Between 14,000 and 12,000 B.P., Masters (1998) has stated, the shoreline was advanced, with sea levels at 30–40 m BPSL, and littoral cells were presenting modern configurations. At about 10,000 B.P., the sea level was 18–20 m BPSL, which resulted in the Point Loma block beginning to define the San Diego Bight. In the subsequent 2,000 years, rise in sea levels was slow, and the climate was stable and perhaps slightly cooler than present. Around 8000 B.P., there was a warming and drying trend, which raised sea levels at a faster rate. By 6000 B.P., several river channels filled with sand, forming the San Diego paleobay, which was rich in bay resources for prehistoric populations (such as those at CA-SDI-4360, located at the south end of the present bay). Tidal flats were formed at several places around Point Loma on the leeward and seaward sides. Between 4500 and 3500 B.P., sea level rose to within 1–2 m BPSL, and, although the bay environment was well developed by 3500 B.P. on the leeward side, where CA-SDI-48 is located, the levees on the seaward side were inundated by rising sea level, and, in general, tidal flats around Point Loma retreated. Thus, Point Loma was surrounded by rocky shoreline by 2000 B.P. The paleocoastal reconstruction of the Point Loma area by Masters (1998) reveals a dramatic change from a bay with sandy spits and barrier beaches with marshes at the mouths of Point Loma River in 6000 B.P. to rocky shoreline starting about 3500 B.P.

2.4.2 Location and Geotopography

The Point Loma landform is uplifted with three formations including the Upper Cretaceous Point Loma Foundation and Cabrillo Formation and the Pleistocene age Bay Point Formation. The hilly terrain with flat areas that are confined to the margins of the shoreline is the Bay Point Formation, and these flat areas are composed of poorly consolidated fossiliferous sandstone (Kennedy 1975). Archeological sites are found in this Pleistocene formation. The elevation ranges from sea level to 121.9 m (400 ft) AMSL. Kennedy (1975) has noted that historical landfills are present along the crest of the peninsula, at the Fort Rosecrans Cemetery and the perimeters of the San Diego Bay.



Figure 6. Point Loma, rocky mainland coast (photograph courtesy of Elise C. Menkhorst).

2.4.3 Environment

Point Loma is characterized by a Mediterranean, semiarid, steppe climate that is moderated by coastal proximity (Bowman 1973; Hines 1991). Rainfall is primarily in the winter and averages 270 mm per year. The primary vegetation includes coastal sage, coastal salt marsh, freshwater marsh, and riparian and coastal sage scrub (Munz 1974). Some introduced plants such as eucalyptus, pickleweed, and grasses are also found. Small terrestrial mammals, birds, and reptiles, including cottontail rabbit, California ground squirrel, and several types of mice and bats, are indigenous faunal resources. Coyote, mule deer, bobcat, and desert wood rat were available in the general wider region. Overall, rocky shorelines have a higher biomass and greater diversity of mollusk and fish species as compared to sandy beaches.

2.5 Mainland Inland Highland

The mainland inland highlands landscape category includes landforms outside the coastal purview and is outside the coastal foraging range. It extends up to 100 km inland east of the coast and reaches elevations from 760 to 975 m AMSL (Figure 7). In this study, five of the ten installations are in this mainland inland highlands landscape category—SERE, MWTF, Detachment Fallbrook, MCAS Miramar, and the Camp Pendleton highlands; however, the landscape of Camp Pendleton will be used as an example and applied to the other four.



Figure 7. Mainland inland highland (photograph courtesy of Mary Beth Stowe).

2.5.1 Location and Geotopography

The inland highlands on Camp Pendleton lie within the Peninsular Ranges geomorphic province, which extends into Baja California (Moratto 1984). On the base, these granitic ranges are represented by the Santa Margarita Mountains and have a maximum elevation of 972 m AMSL. The landscape includes rolling hills and flat terraces cut by drainages and steep, precipitous inclines of the Santa Margarita Mountains with several major drainages flowing northeast to southwest to the ocean. The terraces were formed by coastal uplifting and are mostly Pleistocene marine and nonmarine terrace material overlying Miocene and Tertiary marine deposits (Weber 1963). Some of the drainages that cut through these inland highlands on Camp Pendleton include San Mateo Creek and San Onofre.

2.5.2 Environment

This landscape typically hosts oak woodlands and oak grasslands with drainages of varying sizes. The valleys have rich alluvial sediments and, in some cases, riparian habitat. Vegetation mapping on the base has categorized distinct groups in the inland highlands including southern willow scrub, valley needle grass, nonnative grassland, *Ceanothus crassifolius* chaparral, chamise chaparral, scrub oak chaparral, southern mixed chaparral, sycamore/alder riparian woodland, Engelmann oak woodland, southern coast live oak riparian forest, coastal live oak woodland, southern cottonwood/willow riparian forest, and coastal and valley freshwater marsh (Pacific Southwest Biological Services 1986). The animal resources in the inland highlands include cottontail rabbit, California ground squirrel, several types of mice and bats, coyote, mule deer, bobcat, and desert wood rat. In prehistoric times, pronghorn antelope and black bear may have been available too.

3 Prehistoric Human Adaptations

This chapter presents the most common chronological frameworks used in archeological studies on the islands and the mainland. As it was in the case of Chapter 2, this is not intended to be an exhaustive presentation of the data, but a synthetic discussion of the major time periods and frameworks as relevant to this project.

Archeological investigations in coastal southern California have yielded a diverse range of data that establish human occupation extending from the terminal Pleistocene and early Holocene into the ethnohistoric period. There are many culture-historical frameworks for coastal southern California. Although their goals are varied, they all use traits observed in archeological collections to divide prehistory into cultural periods (Altschul and Grenda 2002; Apple and Cleland 1994; Bull 1975; Byrd 1996a; Clevenger et al. 1993; Erlandson and Colton 1991; Gallegos 2002; King 1981, 1990; Moratto 1984; Raab and Yatsko 1998; Rogers 1945; Strudwick 1995a; True 1966, Wallace 1955; Warren 1964, 1968; Warren et al. 1993; Woodman 1996a, 1996b). There is a notably strong distinction between the chronologies applied to cultural development on the southern Channel Islands and those applied on the mainland; therefore, they are discussed independently.

3.1 Islands

Extant chronological frameworks for the southern Channel Islands were built upon earlier chronologies proposed for the mainland, notably those of Moratto (1984) and Wallace (1955) (Figure 8). In this report, two major frameworks are discussed: Altschul and Grenda (2002) and Erlandson and Colton (1991). Altschul and Grenda (2002) identify a basic culture-historical sequence for archeological research on San Nicolas Island, which includes Paleocoastal, Millingstone, Intermediate, Late Prehistoric, and postcontact cultures. Erlandson and Colton (1991) divide the Holocene into early, middle, and late periods, and their framework has been applied to the San Clemente Archaeological Program by Raab and Yatsko (1990). The relevance and ease of applicability of these two frameworks to the archeology of San Clemente and San Nicolas Islands will be discussed.

3.1.1 San Nicolas Island Chronological Terminology and Framework

Starting in the 1930s with Malcolm Rogers's month long survey of San Nicolas Island, one of the primary objectives of investigations on the island has been the tracing of cultural development through time. Some of the earliest descriptions of culture change on the island come from this early survey by Rogers, who linked changes in midden constituents to three distinct culture sequences; Early period, Canalino period and Shoshonean (Rogers 1993) period.

Radiocarbon Years B.P.	Year A.D./B.C.	Geological Time Scale	Southern Channel Islands		Coastal San Diego County					
			Altschul and Grenda (2002)	Erlandson and Colton (1991), Raab and Yatsko (1990)	Meighan (1954), True (1966, 1970)	Byrd, Pope, and Reddy (2004)	York (2005)	Byrd and Reddy (2002)	Reddy (2007 [this report])	
500	1500	Late Holocene	Late Prehistoric	Late period	Luiŋeño/Diegueño	Late Holocene 4	Late Prehistoric	Late Prehistoric	Late Prehistoric	
1000	1000		Intermediate		San Luis Rey I, II; Cuyamaca complex	Late Holocene 3				
2000	500					Transition or Hiatus	Late Holocene 2	Late Archaic	Archaic	Late Archaic
3000	1000						Late Holocene 1			
4000	2000	Millingstone	Middle period	Millingstone (LaJolla/ Pauma complexes)	Middle Holocene 3	Middle Archaic	Middle Archaic			
5000	3000				Middle Holocene 2					
6000	4000				Middle Holocene	Middle Holocene 1	Early Holocene 2	Early Archaic		Early Archaic
7000	5000									
8000	6000	Early Holocene	Paleocoastal	Early period	San Dieguito	Early Holocene 1	Paleoindian	Paleoindian		
9000	7000									
10,000	8000									

Figure 8. Summary of cultural chronologies used in this study.

The Early period was characterized by concentrations of land snails and small house pits measuring approximately 2.1 to 3.1 m (7–10 ft) in diameter. Overlying Early period deposits, Rogers identified larger sized house pits (9–12 m or 30–40 ft in diameter) and concentrations of red and black abalone, which he attributed to the Canalino period. The more recent island occupation, the Shoshonean period, was characterized by cremations, obsidian projectile points, pestles, metates, and sweathouses. Subsequent to Rogers' work in 1930, numerous culture histories have been proposed for the southern California region, including those by Chartkoff and Chartkoff (1984), King (1981), Kowta (1969), Moratto (1984), Orr (1968), Wallace (1955, 1978), and Warren (1968). In these, there have been efforts to refine San Nicolas Island culture chronologies. For example, Gloria Lauter (1982) examined diagnostic artifacts and features from CA-SNI-11, CA-SNI-16, CA-SNI-18, CA-SNI-40, and CA-SNI-51 and identified three phases in San Nicolas Island chronology: Early (prehistory–3000 B.C.), Intermediate (3000–1000 B.C.), and Late (1000 B.C.–European contact) (Figure 9). Lauter (1982) focused primarily on defining an Intermediate Phase in San Nicolas Island chronology and identified the presence of a well developed fishing technology that lacked shell fishhooks; milling stones and pestles; stone effigies; side notched, triangular, and stemmed projectile points; S-twined basketry; and burials typically in flexed positions.

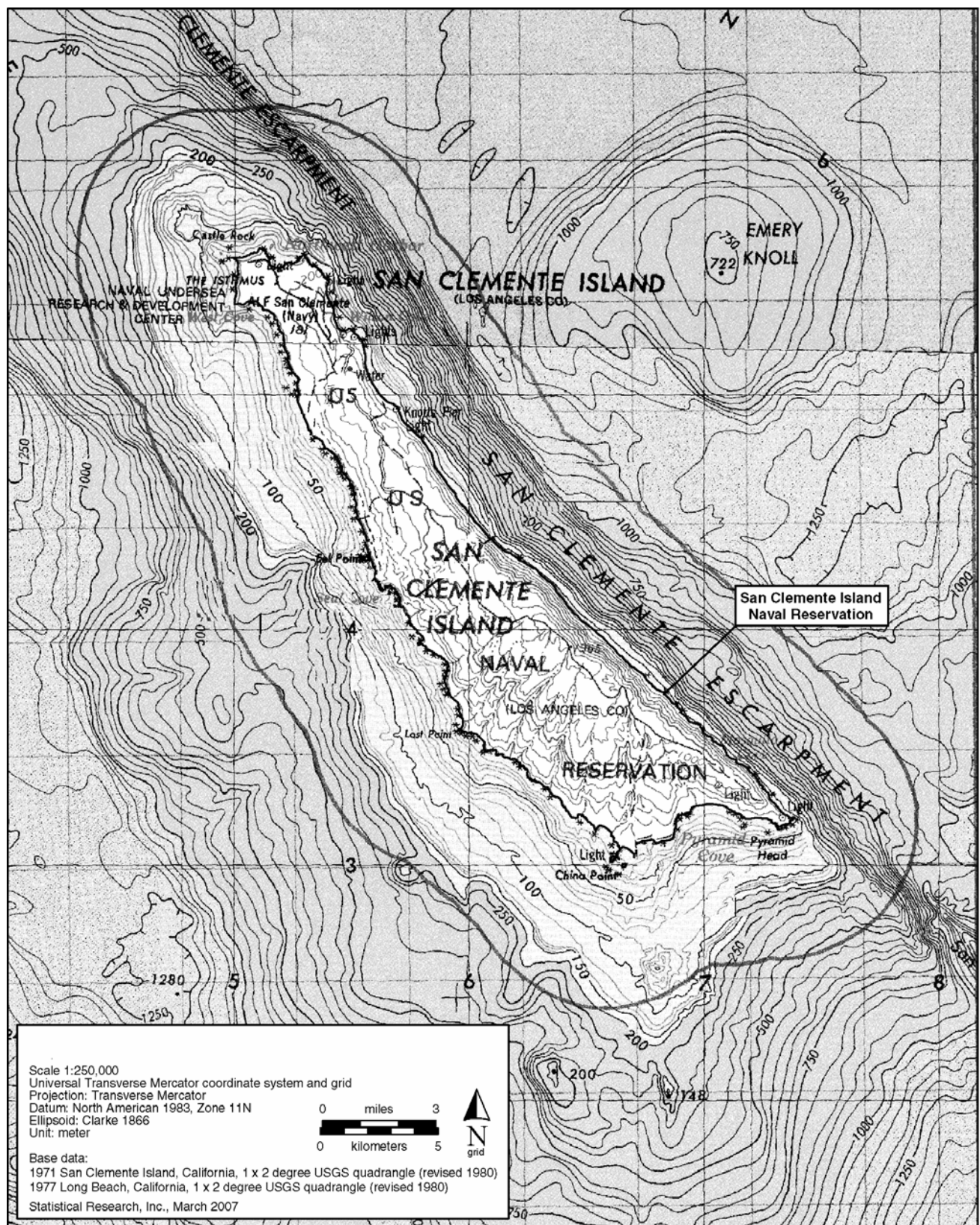


Figure 9. Map of San Clemente Island.

Despite efforts to rigorously define cultural sequences for San Nicolas, the island's chronology is not entirely clear. Cultural histories developed for the California mainland are often applied to San Nicolas Island; however, as Raab and Yatsko (1990) have argued, the mainland sequences do not accurately reflect cultural development on the Channel Islands. To avoid the confusing terminology associated with different cultural sequences, Erlandson and Colton (1991) defined a cultural chronology based on the geologic time scale and three divisions of the Holocene: Early period (10,000–6650 B.P.), Middle period (6650–3350 B.P.), and Late period (3350 B.P.–present). More recently, Altschul and Grenda (2002) proposed a cultural framework for the Los Angeles Basin (i.e., Los Angeles and northern Orange Counties) and southern Channel Islands. Incorporating the results of investigations over the past 5 decades, they defined five periods: Paleo-coastal (prehistory–6500 B.P.), Millingstone (6500–3000 B.P.), Intermediate (3000–1000 B.P.), and Late Prehistoric (1000 B.P.–European contact ca. A.D. 1542). The following discussion briefly reviews our current understanding of San Nicolas Island culture history.

3.1.1.1 *Early Holocene (10,000–6650 B.P.)*

The early Holocene encompasses what Erlandson and Colton (1991) refer to as the Early period and Altschul and Grenda (2002) describe as the Paleocoastal period. During this period, occupation on San Nicolas Island was likely seasonal and appears to have been limited to the island's central plateau, southern coastal terrace, and west end (Martz 2005). To date, only three sites date to this period; however, other seasonal camps may have been present, but have since been inundated as a result of rising sea levels between approximately 9,000 and 7,000 years ago (Martz 2005).

Early prehistoric visitors to the island conducted nearshore fishing using bone gorges, nets, and, perhaps, spears. Prehistoric islanders also hunted sea mammals and collected shellfish. These procurement strategies dramatically differ from those on the California mainland. Mainlanders primarily exploited terrestrial resources and relied more heavily on shellfish than fish (Erlandson and Rick 2002; Erlandson et al. 1999; Rick and Erlandson 2000). Around 6800 B.P., temperatures reached a climatic optimum and began to slowly decrease (Feng and Epstein 1994). The rate of sea level rise began to slow as well. The end of the early Holocene marked the beginning of significant changes on San Nicolas Island and elsewhere in the region.

3.1.1.2 *Middle Holocene (6650–3350 B.P.)*

Sea levels stabilized in the beginning of the middle Holocene, around 6500 B.P. Altschul and Grenda (2002) mark this time as the beginning of the Millingstone period (6500–3000 B.P.). Mortars and pestles appear for the first time on San Nicolas Island. Considering the absence of locally available acorns on San Nicolas Island, Meighan and Eberhart (1953) have suggested that these mortars and pestles were likely used to process some plant materials as well as shellfish, other marine resources, and pigments. This stands in contrast to the mainland, where

manos and metates became more widespread and where mortars and pestles first appear in archeological deposits from around 5000 B.P., signaling an expansion of plant resources to include exploitation of acorns.

Population increased on San Nicolas Island in the middle Holocene, as evidenced by the higher number of sites that date from this time. It is unclear whether the island was used only seasonally; however, considering permanent occupation occurred on the other Channel Islands, it is possible San Nicolas Island was occupied year round (Vellanoweth et al. 2002). Most of the middle Holocene sites are on the west end of the island, although the plateau and southern end were used as well (Martz 2005). Approximately 68 percent of the sites dating to this period are classified as residential; other site types include camps (14 percent), stone artifact manufacture and shellfish processing locations (14 percent), and shellfish processing camps (4 percent) (Martz 2005).

Middle Holocene islanders continued to hunt fish and sea mammals and collected shellfish. Exploitation of large sea mammals for food appears to have decreased during the middle Holocene. This decrease coincides with increased reliance on fish and a variety of shellfish species, including black abalone, turban, limpets, and sea urchin (Rosenthal and Jertberg 1998a, 1998b.)

3.1.1.3 *Late Holocene (3350 b.p. –Present)*

Altschul and Grenda (2002) divide the late Holocene into two periods: Intermediate (3000–1000 B.P.) and Late (1000 B.P.–European contact ca. A.D. 1542). On the mainland, the Intermediate period is characterized by the use of fishing and sea mammal hunting implements, the continued use of mortars and pestles, and the presence of chert knives, steatite bowls, and shell ornaments (Altschul et al. 2003). Evidence of a microlith industry and desert style projectile points may point to the arrival of desert dwelling Takic speakers along the coast. Takic speakers, or Shoshoneans, may have arrived on San Nicolas Island during this time as well.

At the beginning of the late Holocene, there is substantial evidence for year round occupation on San Nicolas Island, and settlement appears to have shifted from coastal regions to the island's central plateau. Occupation increased on the island during this time; however, population density did fluctuate. Radiocarbon dates indicate several occupation peaks: 1050–800 B.C., 50–30 B.C., A.D. 450–700, and A.D. 1200–1540 (Vellanoweth et al. 2002). Declines in population also occurred during 1300–1050 B.C., 550–300 B.C., and A.D. 200–450 (Vellanoweth et al. 2002). Islanders continued to focus their attention on marine resources, particularly fish. Shell fishhooks were widely used on San Nicolas Island, though islanders may have used them during the middle Holocene as well (Vellanoweth and Erlandson 1999). Altschul and Grenda (2002) describe the Late Prehistoric period (1000 B.P.–European contact ca. A.D. 1542) as a time of marked population growth and increasing social complexity along the southern California coast. On San Nicolas Island, regional and long distance trading activities appear to have

intensified as shown by the presence of exotic materials like obsidian, chert, steatite, and serpentine.

There is substantial evidence of *Olivella* spp.—bead production and the manufacture of finely made sandstone bowls and pestles—items that may have been produced for trade and local use as well. Exchange, marriage, political alliances, and ritual congregations likely played important roles in maintaining ties between groups on San Nicolas, the other Channel Islands, and the mainland. Because of a dearth of ethnohistoric information on San Nicolas Island, the nature and extent of social interactions between the San Nicolas islanders and other Channel Islanders—and also with the mainland—is unclear. However, it is clear that other southern California coastal groups knew of the Islanders. Fernando Librado, J. P. Harrington’s Chumash consultant, claimed that the San Nicolas islanders were Gabrielino and originally came from Santa Catalina Island (Hudson 1981). Another one of Harrington’s informants, José de Los Santa Juncos, described the islanders as “... powerful witches. They passed to and from the islands on *basalas* of *Tules* [bundled reed canoes]” (Harrington 1986:R104F40).

The presence of exotic materials on San Nicolas Island attests to trade interactions with other groups on the Channel Islands and the mainland. These materials include steatite, serpentine, Monterey and Franciscan cherts, obsidian, deer bones, wild cucumber (*Marah* sp.), red maids (*Calandrinia* sp.), and manzanita (*Arctostaphylos* sp.) (Rick et al. 2001; Schwartz and Martz 1992; Thomas 1995; Vellanoweth et al. 2002). San Nicolas Islanders likely obtained these items from Gabrielino on Santa Catalina Island and the adjacent mainland, Chumash islanders and mainlanders, Luiseño, Juaneño, and Great Basin groups. It is unclear, however, whether San Nicolas islanders participated in direct or down-the-line exchange.

In addition to trade interactions, San Nicolas islanders appear to have shared similar ritual practices with Gabrielino groups on San Clemente Island and the mainland. The ritual burial of dogs has been associated with the Chingichngish religion. Dog burials have been recovered on San Nicolas Island, including, most recently, at CA-SNI-25 (Cannon 2006; Vellanoweth et al. 2007). On San Clemente Island, ritually interred dog burials have been recovered from the Lemon Tank site (CA-SCLI-1524). The Lemon Tank site also contains evidence of ritual feasting (Hale 1995), including food caches and pits similar to those identified at CA-SNI-25 (Cannon 2006). Big Dog Cave (CA-SCLI-119) has yielded Chingichngish type ritual assemblages. Dog burials have also been identified at sites in the Gabrielino mainland territory at Encino Village (CA-LAN-43), Golf’s Island, Malaga Cove, and CA-ORA-58 (Martz 1994). Considering the similarities in ritual practices, it is highly possible that San Nicolas Islanders participated in ritual congregations with Gabrielino groups from San Clemente Island and the mainland.

Currently, it is unclear whether the San Nicolas Islanders maintained ties with the other Channel Island and mainland groups through marriage, political alliances, other social interactions. Future research efforts should focus on identifying and

3.1.2 San Clemente Island Chronological Terminology and Framework

Raab and Yatsko (1998) eloquently argued for the application of Erlandson and Colton's (1991) three part division of California coastal prehistory to San Clemente archeological investigations. They presented three advantages for the use of this division: it reflects broad cultural transitions, its Holocene time scale offers a consistent temporal scale for modern archeologists, and it is a reasonable framework for San Clemente Island (Raab and Yatsko 1998). The following review summarizes our current understanding San Clemente cultural evolution through the early Holocene (10,500–7,000 radiocarbon years B.P. [RYBP]), middle Holocene (7,000–3,500 RYBP) and late Holocene (3,500 RYBP–A.D. 1769).

3.1.2.1 *Early Holocene (10,500–7,000 RYBP)*

The early Holocene encompasses what Erlandson and Colton (1991) refer to as the Early period and Altschul and Grenda (2002) describe as the Paleocoastal period. On San Clemente Island, occupation during this period is best illustrated at the Eel Point site (CA-SCLI-43) located on the Coastal Terrace (Figure 10). Raab and Yatsko (1998) establish the initial occupation at the site by about 8,000 RYBP, which places it among the oldest known coastal sites in California. The noteworthy aspect of the early Holocene occupation at Eel Point (CA-SCLI-43) is the richness of the faunal and artifact assemblages, and their extraordinary level of preservation. The focus of subsistence practices was on maritime hunting and fishing, and, as stated earlier, this adaptation was markedly different from that observed on the mainland during the analogous Millingstone period, which was dominated by ground stone equipment. The early Holocene occupants of Eel Point (CA-SCLI-43) had a very productive marine economy that included seal, sea lion, and dolphin hunting and shellfish collecting (Garlinghouse 2000, Porcasi et al. 2000). Early Holocene sites are not found outside the Coastal Terrace topographic zone; however, dating of deflated shell middens in the different zones, which would be necessary to conclusively model the early Holocene settlement pattern on San Clemente Island, has been limited.

3.1.2.2 *Middle Holocene (7,000–3,500 RYBP)*

At the beginning of the middle Holocene, sea levels stabilized; this time is marked at the beginning of the Millingstone period by Altschul and Grenda (2002). As discussed earlier, the mainland cultures were marked by widespread use of mano and metate equipment. The middle Holocene on San Clemente Island witnessed the emergence of small maritime villages (as noted at the Nursery site (CA-SCLI-1215) and Eel Point-CA-SCLI-43) (see Figure 10).

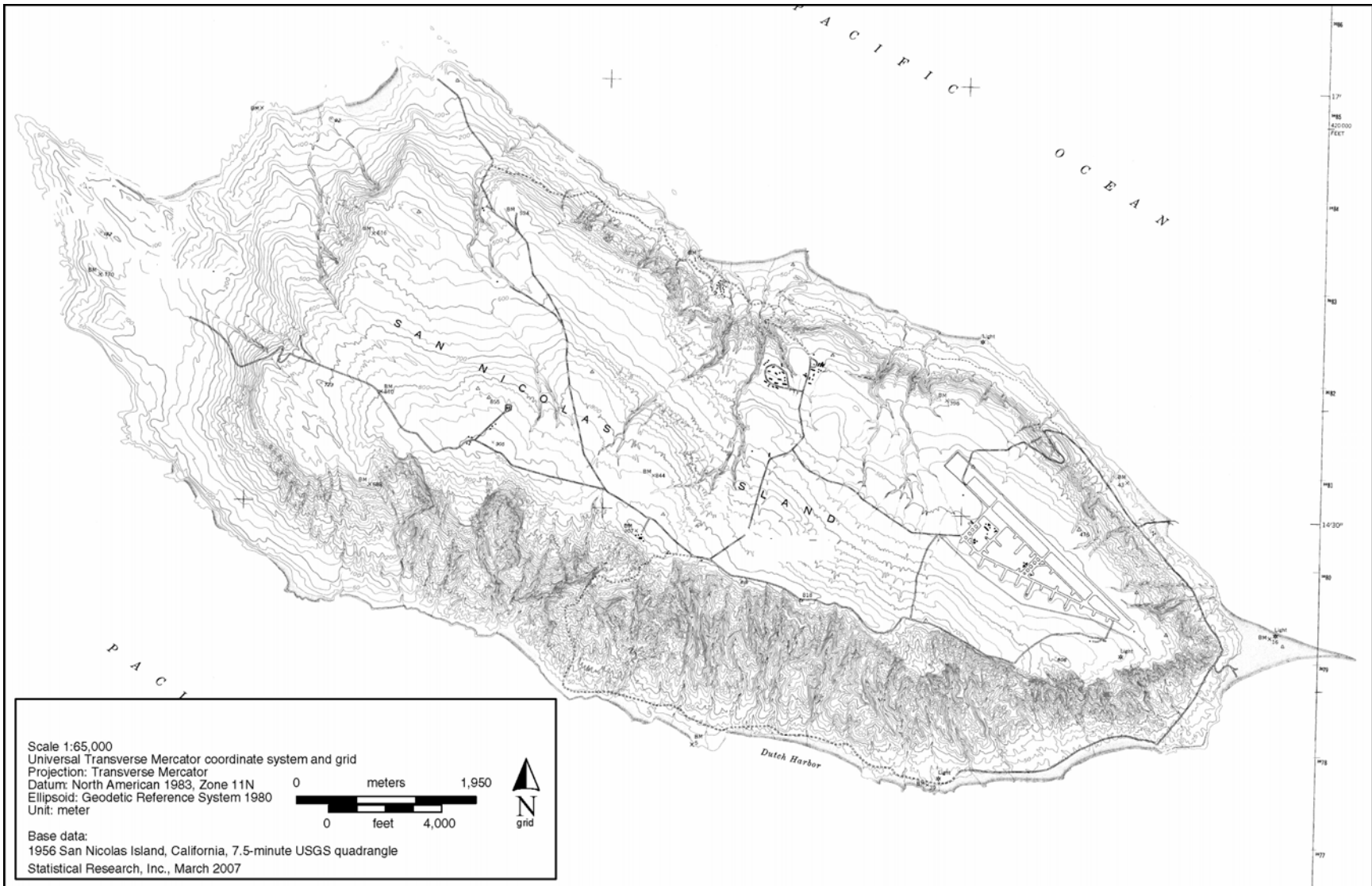


Figure 10. Map of San Nicholas Island.

Pit house communities with extensive midden deposits date to as early as 5,200 RYBP, and island occupants engaged in a regional cultural interaction sphere linking the southern Channel Islands to a large mainland section of California and the Great Basin (Howard and Raab 1993). In addition to these communities, small sites were scattered in the northern part of the island in the Sand Dunes and on the Plateau (Byrd and Andrews 2003; Strauss 2004).

As in the case of San Nicolas Island, the population on San Clemente Island increased in the middle Holocene (Raab and Yatsko 1998). Middle Holocene San Clemente islanders continued to hunt fish and sea mammals and also collected shellfish. At Eel Point (CA-SCLI-43), the highest maritime productivity is associated with the middle Holocene middens, with fishing the primary focus of exploitation. By the end of the middle Holocene there is a marked decrease in maritime exploitation, perhaps due to overexploitation and/or changes in the marine environment (paleotemperature). The decrease in maritime exploitation is correlated with an increased focus on smaller fish and shellfish.

3.1.2.3 Late Holocene (3,500 RYBP–a.d. 1769)

The late Holocene on San Clemente Island was a period of complex and dynamic local and regional culture changes. At Eel Point (CA-SCLI-43), the middle Holocene focus on large sea mammal hunting and the collection of productive shellfish was replaced by intensified fishing of smaller fish, small sea mammal hunting and the collection of a large variety of shellfish in the late Holocene (Byrd and Raab, in press).

Distinct settlement patterns emerged, with smaller sites being nonrandomly distributed and short-term, specialized sites located strategically around larger, residential camps. Such sites have been recorded across the island in the Coastal Terrace, Upland Marine Terraces, Sand Dunes, and Plateau topographic zones (Byrd 2000; Byrd and Andrews 2002, 2003; Strauss 2004).

The late Holocene on San Clemente Island was a time of increased population growth and emerging social complexity. The presence of exotic materials like obsidian, chert, steatite, and serpentine gives evidence of regional and long-distance trading. There is evidence for the manufacture of *Olivella* spp. beads and stone bowls, items used for trade and local use (Raab and Yatsko 1998). The late Holocene inhabitants of the island are often referred to as the Island Gabrielino (see for example Raab and Yatsko 1998) and are characterized by a loss of maritime foraging efficiency and the acute stress associated with European contact.

3.2 Evaluation of the Chronological Frameworks

The report focuses on two cultural chronological frameworks for the southern Channel Islands—one developed by Erlandson and Colton (1991) and the other by Altschul and Grenda (2002). Erlandson and Colton's (1991) use of the geologic time scale eliminates the confusing terminology often associated with culture chronologies. Additionally, as Erlandson and Colton (1991) point out, the Holocene divisions are not entirely arbitrary, but instead, coincide with several

important changes in prehistory. For example, on the mainland and southern Channel Islands, the exploitation of fish and sea mammals rose in importance relative to the collection of shellfish during the early–middle period transition (7000–6000 B.P.), and the archeological record indicates that mortars and pestles first appeared during the same time (Erlandson and Colton 1991). During the middle–late period transition, there is a diversification of food resources exploited, technology, and ornaments. Other major cultural changes occur on San Nicolas Island, but they are not distinguished as separate cultural phases in Erlandson and Colton’s (1991) early middle late–period chronology.

One of the advantages of Altschul and Grenda’s (2002) cultural chronological framework is that, rather than relying on somewhat arbitrary geologic time scale divisions, it highlights several significant changes in prehistory that are not distinguished in Erlandson and Colton’s (1991) framework. For example, the Intermediate period is characterized by intensified fishing activity on San Nicolas Island, likely associated with the use of shell fishhooks. Additionally, the early part of the Late Prehistoric period marks the beginning of rapid culture change on the Channel Islands and adjacent mainland. However, the Millingstone period does not necessarily accurately reflect culture history on the islands. Mortars and pestles do first appear on the islands during this time; however, considering the island’s limited terrestrial resources, this period does not necessarily reflect intensified use of terrestrial resources, as it does on the mainland. Furthermore, as noted earlier, Altschul and Grenda’s (2002) cultural chronological framework describes the prehistory of both the Los Angeles Basin and southern Channel Islands. Although this framework provides an important cultural connection and comparison between the islands and mainland, it does not necessarily highlight important cultural changes that are specific to the two islands.

The two cultural chronological frameworks discussed above both have important advantages and disadvantages. Considering that culture history on the islands is not entirely understood and that there are many data gaps, it is difficult at this time to determine whether one framework is more relevant or applicable than the other. Future investigations should focus on refining the chronologies. The issue of the relevance of the two cultural chronology frameworks may become more clear once a firm understanding of island culture history is in place. To elucidate the culture histories of the two islands, future investigations should focus on the research issues defined in Chapter 4; however, future research investigating island chronology should not be limited to these research issues. These issues are intimately connected to the major research themes discussed throughout the report.

3.2.1 Mainland Chronological Terminology and Framework

Given that the primary mainland installations to be considered in the report (Camp Pendleton and NB Point Loma) are located in San Diego County, the chronological frameworks used exclusively in this region will be emphasized. Rogers (1929, 1945) was the first to establish a cultural sequence for San Diego County, and scholars have subsequently modified his framework to construct their own. Wallace (1955) offered a cultural sequence that integrated both the inland

and coastal areas and placed San Diego County in a regional perspective. Around the same time, Meighan (1954) and True (1966) successfully integrated late inland adaptations with nearby coastal developments. In general, no single chronological sequence or terminology for San Diego County has widespread acceptance. Instead, there is a plethora of terms and chronological sequences that often results in unsystematic approaches. This is compounded by a general lack of conformity and consistency in the use (and statement) of RYBP versus B.P. uncalibrated dates. To add to this challenging situation, sometimes, other geoculture specific terms, such as San Dieguito, La Jolla, Pauma, Encinitas, and San Luis Rey, are also used. To avoid further confusion, Byrd et al. (2004) and Byrd and Berryman (2006) have recently suggested adopting an arbitrary chronological classification based on calibrated radiocarbon dates. This classification divides time into finer segments as one approaches the present. They argue that such a framework provides an accurate control on time and allows archeological and paleoenvironmental results (which use calibrated dates almost exclusively) to be compared accurately. Such a framework facilitates exploration of long term trends without being constricted by preconceived cultural adaptive sequences. Byrd and Berryman (2006) have acknowledged that such a framework does not necessarily ignore temporal developments, but it provides a finer grained structure to track trends and elucidate key events.

The objective of this research project is not to discuss all the chronological sequences that have been proposed for the area, but to present a sequence that would be most effective for the sandy and lagoonal mainland coast, rocky mainland coast and mainland inland highland landscapes under consideration in this project. The three most commonly used for these landscapes are:

- Paleoindian period to Archaic period to Late Prehistoric period (Byrd 1996a; Reddy and Byrd 1997; Woodman 1996a, 1996b);
- Paleoindian period to Early Archaic period to Late Archaic period (Apple and Cleland 1994); and
- Early period to Late period (Clevenger et al. 1993; Gallegos 2006; Strudwick 1995a).

In this report, a combination of culture-historical and geological terms will be used to outline the cultural developments in San Diego County (Table 3). The culture-historical terms to be used are Paleoindian period, Archaic period and Late Prehistoric period these are linked to early, middle, and late Holocene geologic time spans. This three division framework is selected as opposed to the two division (Early and Late period) framework because it offers more resolution on the time scale. The two division framework, as conceived by, for example, Gallegos (2006), collapses 8,700 years (from 10,000–1300 B.P.) into a single temporal period (citing cultural stability) and sets the Late period at 1300 B.P.–present. The three division framework also includes a large time span in the Archaic period (7,700–8,200 years), but it nonetheless provides greater relative resolution.

3.2.2 Paleoindian (> 77000 cal B.C.)

The earliest occupations of the region date to 8,000–9,500 years ago and centered around coastal lagoons and river valleys in San Diego County (e.g., the Harris site

[CA-SDI-149], the Agua Hedionda sites, Rancho Park North, Remington Hills, and the Red Beach sites on Camp Pendleton). There has been considerable debate about the Paleoindian cultures of this region since Rogers (1939, 1945) coined the term “San Dieguito” to refer to the earliest artifact assemblages. San Dieguito assemblages have been a viable Paleoindian complex for several scholars (Moratto 1984; Warren 1967). Our understanding of the San Dieguito during this 1,500–2,500 year span in the early Holocene is gleaned primarily from the Harris site in west-central San Diego County. Characterized as a late Paleoindian occupation—with scrapers and scraper planes, large bifaces, and large projectile points—by Rogers (1939), this tool complex most likely represented a big game hunting focus.

The relationship between San Dieguito tradition and La Jolla complex was the center of major discussions in the 1980s. At issue was whether they were temporally similar and simply functional variants of a single adaptive system (Bull 1987; Gallegos 1987) or truly temporally distinct (Rogers 1945; Warren 1968). Initially, San Dieguito assemblages were characterized by an absence of milling tools (Warren 1967), but, more recently, Warren et al. (1998) included milling tools into a Transitional Period II (San Dieguito–La Jolla); bringing the debate regarding San Dieguito (Paleoindian) and La Jolla (Archaic) to a new juncture. Now, the debate centers on whether there is a transition between San Dieguito and La Jolla, and, if so, whether it is related to population replacement, acculturation, or transformation (Gallegos 1987, 2006; Warren 1987; Warren et al. 1998). Recent work on the Channel Islands and along the southern California coast has delineated a strong maritime economy and could well support the functional variants model. There is minimal evidence of Paleoindian sites or artifacts in the sandy and lagoonal mainland coast, rocky mainland coast, and mainland inland highland landscapes under consideration in this project (Hale and Becker 2005; Reddy 2005). CA-SDI-12568, located on a low terrace in the northern portion of the Ysidora Basin on Camp Pendleton, yielded dates placing occupation in the early Holocene (8720–8220 cal B.P.) (Collett and Bull 2005) (Figure 11). The site yielded two dates on *Chione* shell with 2-sigma calibrated ranges of 8720–8220 and 8110–7550 cal B.P., as well as two additional dates of 6930–6320 and 6630–6260 cal B.P. Given the absence of associated artifacts, human occupation at the site in the 8720–8200 cal B.P. time period cannot be assumed.

3.2.3 Archaic Period (7000 cal B.C.–cal A.D 650.)

The Archaic period covers a long span of 7,700–8,200 years; it begins in the early Holocene, extends through the middle Holocene, and ends in the early part of the late Holocene. Bull (1987), Gallegos (2006), Moratto (1984), and others consider it a period of cultural stability. Cultural terms such as San Dieguito, La Jolla, and Pauma are used for some of the early Archaic period cultures (Gallegos 2006; Rogers 1945; True 1958, 1980; Warren 1964). The origin of these early inhabitants—whether they were Great Basin/desert populations coming from the east or populations from the north—is uncertain. Both coastal maritime exploitation and inland resource utilization quickly became important economic strategies. The primary distinction between the Archaic and the Paleoindian adaptations is the

change in subsistence strategy from specialized big game hunting to generalized diverse exploitation.

In general, Archaic period occupations were concentrated along lagoons and estuaries on the coast, where populations had access to abundant marine, tidal, lagoonal and terrestrial resources. The stone tool complex is relatively simple, but marked by a high frequency of milling equipment. The settlement patterns are not well understood, however, there might have been a seasonal component of the inland Pauma complex contemporary with the coastal La Jolla adaptations. There is little agreement on whether the inland Pauma and the coastal La Jolla were seasonal expressions or distinct cultures. Sites with Archaic period culture signatures have been reported from a range of habitats within the sandy and lagoonal mainland coast, rocky mainland coast and mainland inland highland landscapes of this project including coastal settings, inland valleys, canyons, and knolls. The Archaic period sites are distinguished by grinding implements (manos and metates), discoids, cobble tools, and flexed burials.

Table 3. Time scales and periods used in the discussion of the Southern California mainland coastal and inland landscapes.

Period, by Time Scale	Time Range (calibrated) ^a
Geological	
Early Holocene	7000–5600 B.C.
Middle Holocene	5600–1650 B.C.
Late Holocene	1650 B.C.–A.D. 1700
Cultural	
Archaic	> 7000 B.C.–A.D. 650.
Early Archaic	> 7000–4050 B.C.
Middle Archaic	4050–1550 B.C.
Late Archaic	1550 B.C.–A.D. 650
Late Prehistoric	a.d. 650–1700
^a From Byrd et al. (2004), Byrd and Reddy (2002), and York (2005).	

The earliest Archaic period occupation on the rocky coast landscape of Point Loma was at CA-SDI-48, which has a record of human occupation from 5000 cal B.P. (Gallegos and Kyle 1998) (Figure 12). The site is located on the bay side of Point Loma. Another site, CA-SDI-10945, also on the bay side, has evidence of human occupation dating to 2000 cal B.P. (Pignuolo et al. 1991). Both sites are characterized by evidence of a maritime subsistence system (Noah 1998).

Archaic period occupation on Camp Pendleton is well represented on the coastal landscapes, but absent in the mainland inland highland. The earliest date for human occupation on Camp Pendleton, 6700 cal B.C., was obtained from CA-SDI-12628, which is located within the Santa Margarita River lower drainage system and less than 4.8 km from the coastline. In addition to this, there are other early Holocene sites located on the coastal terraces (CA-SDI-10728 Locus A and CA-

SDI-10723) and along the Santa Margarita River system (CA-SDI-4416 and CA-SDI-10156 Locus A) (see Figure 11). The coast was occupied by humans mostly in the late Holocene (1650 cal B.C.–1700 cal A.D.), and the inland highlands were not utilized until after A.D. 900.

Starting at about 3,500 years ago (the onset of the late Holocene), there was an important and meaningful reorganization in the settlement system along coastal northern San Diego County within the sandy and lagoonal mainland coast landscape. Some parts of this landscape, such as Batiquitos Lagoon, appear to have been abandoned, with populations moving south and east (Gallegos 1985; Warren 1964). In contrast, other portions of the area, such as the Red Beach area on Camp Pendleton, had continued an intensive occupation into the subsequent period (Byrd and Reddy 1999, 2002; Reddy 1999). As discussed in Chapter 2, it is very likely that the paleoenvironment of the different lagoons and drainages were very distinct during this time, and the cultural adaptations reflect this highly dynamic coastal context.

3.2.4 Late Prehistoric Period (cal a.d. 650–1700)

The Late Prehistoric period (also referred to as the Late period) spans a 1,100-year period in the later part of the late Holocene. This culture change is considered to have begun between 2000 B.P. and 800 B.P., depending on the scholar (Moratto 1984; Gallegos 1987, 2006; True 1980; Warren 1964). The archeological record shows a proliferation of sites into all types of landscapes, and an overall increase in site density. The adaptation is characterized by small, arrowhead-sized projectile points, ceramics, increased milling in the inland highlands, and the appearance of cremation. Given its temporal proximity to Spanish contact (and therefore to ethnohistoric accounts), archeologists have tended to directly use ethnohistoric models to explain Late Prehistoric human behavior as it pertains to settlement patterns, subsistence strategies, and social systems. Thus, ethnohistoric accounts of the Luiseño and Juaneño in northern San Diego County and the Kumeyaay/Diegueño cultures of central and southern San Diego County are used extensively.

The Late Prehistoric period also witnessed the appearance of new populations—the Shoshonean speakers moving into the northern part of the county after 1500 B.P., and the Yuman speaking people from the eastern Colorado River region moving into the southern part of San Diego County around 2000 B.P. The prehistoric Cuyamaca complex is considered to represent the Yuman ancestors of the Kumeyaay (True 1970), whereas the San Luis Rey complex corresponds to the Shoshonean predecessors of the Luiseño in northern San Diego County (Meighan 1954; True et al. 1974).

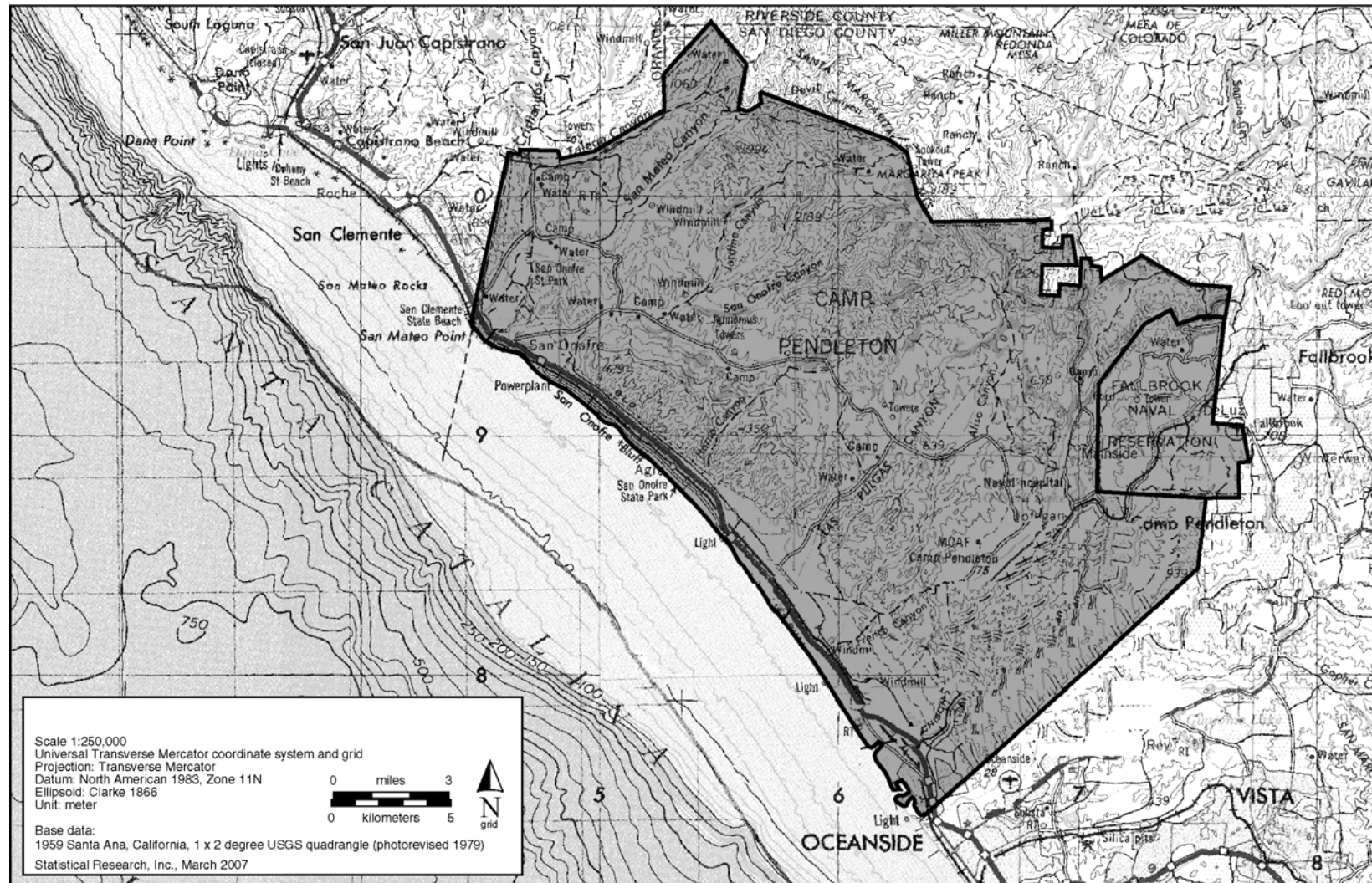


Figure 11. Map of Camp Pendleton.

In northern San Diego County, the Late Prehistoric period is represented by the San Luis Rey complex and is characterized by the appearance of small projectile points (indicating the use of the bow and arrow), ceramics, and the replacement of inhumations with cremations (Meighan 1954). True (1966) and True et al. (1974) consider the San Luis Rey complex to mark the arrival of Takic speakers from regions further inland. Waugh (1986) is in general agreement with True, but suggests that the migration was probably sporadic and took place over a considerable period. Thus, the San Luis Rey complex was originally delineated by Meighan (1954) and then redefined by True (1966), True et al. (1974), and True and Waugh (1982, 1983). It is divided into two phases: San Luis Rey I (1500–500 B.P.) and San Luis Rey II (500–200 B.P.), the primary distinctions being the appearance of ceramics, pictographs, steatite arrow shaft straighteners and Euroamerican artifacts (glass and metal) in San Luis Rey II. The timing of these phases is not always agreed upon, and even True and Waugh (1983) have suggested that San Luis Rey II might have begun as late as A.D. 1600. Recent radio-carbon dates from carbon residue on potsherds seems to confirm the A.D. 1600 date. However, a date of A.D. 1460 from carbon residue on a potsherd was derived from a site in the uplands of Camp Pendleton (Stanley Berryman: personal communication).

True (1970) described the Cuyamaca complex as largely similar to the San Luis Rey complex, with the exception of a higher frequency of side notched points, flaked stone tools, ceramics, and milling stone implements. In addition, the Cuyamaca cultures had a steatite industry and placed cremation in urns. The higher frequency of milling stone equipment has been challenged by Gross et al. (1989), who found similar frequencies at several San Luis Rey sites in the northern part of the county.

Both of these Late Prehistoric adaptations had initially fairly mobile populations that transitioned to a more logistically planned seasonal settlement system. There is discussion about a change from limited logistical mobility in San Luis Rey I to a sedentary village life in San Luis Rey II (True et al. 1991; True and Waugh 1982). However, this appears to be based as much on direct analogies with ethno-historic accounts as it is on archeological data, which is all primarily from the uplands, with little data from the coast.

Late Prehistoric occupation on Camp Pendleton is extremely well represented across the landscape—particularly in the inland highlands—with the majority of the sites in this landscape dating to after A.D. 950. One of the current debates is whether land use in coastal and inland settings was similar or distinct (Byrd 1998; Byrd et al. 2004; Byrd and Reddy 2002; Reddy 1999; Rosenthal et al. 2001) is currently being debated. Byrd (1998), Byrd et al. (2004), Byrd and Reddy (2002), and Reddy (1999) have argued that there is a diachronic trajectory beginning in 700 A.D. (San Luis Rey I) that involves an increase in site density and an increase in the variety of specialized sites and residential bases. This was interpreted as the emergence of a complex settlement pattern, with major residential bases along key drainages and more specialized sites clustered around them, as in Binford's (1980) radiating organizational strategy.

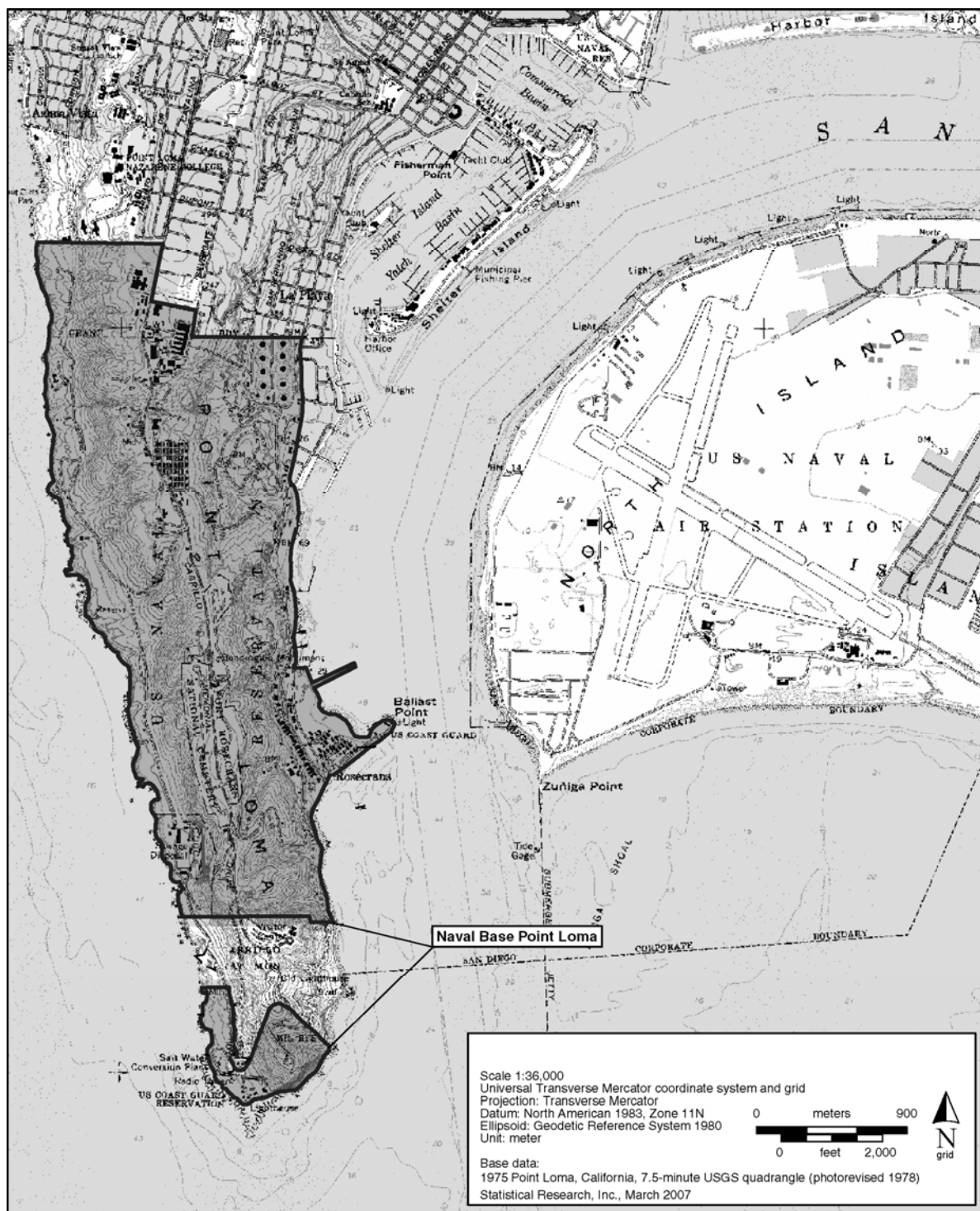


Figure 12. Map of Point Loma.

Rosenthal et al. (2001) argue instead for a deintensification of the coast and a focus on inland resources and, in doing so, follow True's model (True and Waugh 1982, True et al. 1991). It should be noted that Rosenthal et al. (2001) did not consider the large coastal data set (Reddy 1999) in their research. Their model placed considered amount of importance on archeological datasets that are characteristic of inland sites rather than coastal (namely ceramic and projectile point, both of which are not encountered on coastal sites). The reconstruction model of Late Prehistoric occupation along the prehistoric coast of Camp Pendleton proposed by Byrd (1998) and Reddy (1999) is supported by the presence of large scale contemporaneous sites farther south along the San Diego coastline (Byrd and Reddy 2002). This trend of intensive residential sedentism along the San Diego coastline continues into the Spanish period, based on Spanish accounts and detailed mission records that document the presence of numerous ethnohistoric coastal villages (Johnson 1999).

The postcontact period began in A.D. 1769 with the establishment of Mission San Diego de Alcalá. However, the first cultural contact between the Spanish and Native populations was much earlier, in A.D. 1542, when Cabrillo landed at Point Loma.

4 Research Issues

The goal of the report is to develop a regional, archeologically based, historic context for archeological investigations on the installations represented in the SDSSCAR. In providing a regional thematic research design, the document strives to link anthropologically oriented problems with material correlates of the archeological record. To do so, the theoretical and thematic objectives of the research design are defined as a series of potential research themes and approaches. The research issues have relevance and importance to the SDSSCAR. The major research themes include chronology, paleoenvironment, first inhabitants, subsistence change, settlement patterns, technological innovation, ideology, and culture contact.

4.1 Theme: Temporal Placement/Chronology

This research theme ties in well with the discussion in Chapter 3 of chronological frameworks and their lack of congruity. Given that several cultural chronologies are currently used within the region, an integral objective of future studies should be to determine which framework is most applicable and to move away from culture-specific frameworks. Instead, standardized frameworks, which address major research problems, should be applied.

Research issues related to temporal placement and cultural chronology are distinct for the islands and the mainland for a variety of reasons. Therefore, the islands will be discussed together, whereas temporal research issues for the mainland landscapes will be addressed separately. Research questions for the three mainland landscapes (sandy and lagoonal coast, rocky coast, and inland highlands) are collapsed into a single category because they are shared by all three landscapes. There are, however, some research issues that crosscut the landscapes. For example, the Early to Middle period transition (7000–6000 B.P.) on the southern Channel Islands is often defined by a shift to the use of mortars and pestles (suggesting plant food intensification) and the blossoming of fishing technologies. This is an important research issue that parallels early Archaic adaptations on the mainland.

4.1.1 Islands

Seven major research questions have been identified through a review of archeological literature on San Clemente Island and San Nicolas Island. Radiocarbon dating has been more prevalent on the islands than on the mainland; and San Clemente Island has approximately 400 radiocarbon dates, and San Nicolas Island has at least 275 (Martz 2002; Raab and Yatsko 1998; Yatsko 2000). This rich data base allows us to move toward tracking the pace of change at a relatively sophisticated level, and also facilitates posing explicit research questions. The seven questions presented below are not intended to be the final word on structuring temporal and cultural chronological investigations; instead, they highlight some

intriguing and significant gaps in the understanding of the timing of specific human activities on these two islands.

1. What is the nature of overall early Holocene occupation on San Clemente Island, especially in the Upland Terraces, Sand Dunes and Plateau?

On San Clemente Island, the oldest site, Eel Point (CA-SCLI-43), is also the most well documented, and it is located on the Coastal Terrace (Raab and Yatsko 1998; Yatsko 2000). However, no other evidence of early Holocene occupation on the island has been identified, neither on the Upland Terraces, in the northern Sand Dunes nor on the Plateau. It is possible that camps may have been present on the lower reaches of the Coastal Terrace, but have been inundated by the rising sea levels. It is also possible that small camps may be present in the inland portions of the island, but are currently undocumented. The presence (or absence) of evidence of early Holocene occupation across the San Clemente Island landscape would be invaluable in comparing land use on this island to that noted on San Nicolas.

Considering that, during the middle Holocene, San Nicolas was occupied primarily in spring and fall, it is likely that early Holocene habitation was seasonal as well. Three known sites, situated on the island's central plateau, southern coastal terrace, and west end date to the early Holocene (Martz 2005). Early Holocene seasonal camps may have been present, but have since been inundated as a result of rising sea levels between approximately 9,000 and 7,000 years ago. Based on extensive erosion and proximity to the mainland, Bryan (1970) suggests that the southeast coast, in particular, is the most likely portion of San Nicolas Island to have witnessed early Holocene occupation.

2. What activities and artifacts characterized the Early to Middle period transition on the islands?

Erlandson and Colton (1991) note that mortars and pestles—presumably for the processing of acorns and other plant resources—first appeared widely in coastal California during the Early to Middle period transition (7000–6000 B.P.). Other types of resources were also exploited as evidenced by the increased reliance on sea mammals and fish relative to shellfish. The nature of past behavior and associated artifacts that characterized the Early to Middle period transition, however, is not well understood on San Clemente and San Nicolas Islands (Raab and Yatsko 1998). More research is needed to compare and contrast the earlier sites with transitional period sites. What resources were commonly exploited and how do they compare, in terms of types of resources and relative abundance, to those utilized prior to the transition? Do mortars and pestles first appear widely on both islands at the same time as they do on the mainland? Considering the limited terrestrial resources on San Nicolas Island and the absence of locally available acorns, what were mortars and pestles typically used for during the transitional period on this island?

Understanding the changes that occurred during this transitional period will require identifying sites occupied during this period and comparing them to sites dating prior to 7000–6000 B.P. Characterization of transitional sites is essential.

Site characterization should include, though it should not be limited to, the following information: site location (landscape using the discrete landscape categories for each island); site type (e.g., fishing camp, shellfish processing location, lithic scatter, etc.); the types and relative abundance of fish, shellfish, and sea mammal resources exploited; the presence or absence of mortars and pestles; and the types of diagnostic artifacts present. Residue analysis should be conducted on mortars and pestles recovered from transitional sites to determine the types of resources that were processed. In addition, flotation of cultural sediments is recommended to recover macrobotanical remains and sampling for microbotanical analysis. With site characterizations in place, sites occupied during the transitional period can be compared to earlier sites, with a focus on changes in subsistence patterns and how subsistence patterns may relate to site location. Additionally, comparisons of diagnostic artifacts may reveal changes in technologies and other cultural attributes. Finally, with a clearer understanding of Early to Middle Period transition culture history in place, comparisons with the northern Channels Islands and coastal southern California mainland will help to determine how the two islands fit into regional chronologies developed for this time period.

3. When did fishing become a primary subsistence focus on San Nicolas Island, and how does that compare to the evidence from San Clemente Island? Were similar causal factors at play on both islands?

Compared to shellfish collecting, fishing became increasingly important during the Early to Middle period transition on both islands. On San Nicolas Island, dietary reconstructions at CA-SNI-161 suggest fishing may have intensified significantly around 5,000 years ago (Vellanoweth and Erlandson 1999). Based on recovery of large bone barbs and large projectile points at Eel Point (CA-SCLI-43), Raab and Yatsko (1998) and Meighan (2000) suggest that there was technological elaboration by the end of the middle Holocene. San Clemente Island also witnessed increased focus on fishing in the middle Holocene. The question, however, on when exactly fishing became a primary subsistence focus on the islands and what factors might have caused this shift in resource exploitation remains. The development of the shell fishhook is often attributed to intensified fishing activities. On San Nicolas Island, CA-SNI-161 yielded one of the earliest shell fishhooks known from the island from a context dating to approximately 3000 B.P. (Vellanoweth and Erlandson 1999). Based on research at Eel Point (CA-SCLI-43), Raab and Yatsko (1998) suggest that circular shell fishhooks first appeared on San Clemente Island around 3,300 RYBP. Thus, when shell fishhooks first appeared on the islands and when they became widely used remain important, but unresolved, research questions. Raab and Yatsko (1998) have argued that exploitation of smaller fish increased at the end of the middle Holocene, perhaps as a result of overexploitation of large fish and sea mammals and/or changes in the paleotemperature.

In addition to chronometric data, addressing this research issue requires analysis of midden constituents from sites occupied during the early, middle, and late Holocene. Comparisons of midden constituents will help to determine when fish, and particular types of fish, became a primary subsistence focus. Analysis should also include comparisons of fishing gear (e.g., bone gorges, shell fishhooks, net

weight stones, etc.). Substantial and specialized fishing gear toolkits likely correspond to intensified fishing activities. Additionally, shell fishhooks found in early deposits should be dated, either directly or by association (if the context is reliable), to determine the earliest appearance on the islands and when they first appear to be widely used.

4. Was the Middle to Late period transition (a.d. 1100–1300) on the islands a period of changing ocean temperatures and marine productivity associated with changes in social complexity?

The Middle to Late period transition has been identified as a crucial time in prehistory (Arnold 1992; Kennett 1998; Raab and Larson 1997). This period has been characterized as a time of extreme drought (Raab and Larson 1997) and elevated sea surface temperatures (Arnold 1992) that may have depressed marine activity. However, recent studies suggest instead that ocean temperatures may have been cold and that the period may have been highly productive (Kennett and Kennett 2000; Kennett and Conlee 2002). Despite the uncertainty regarding ocean temperatures and marine productivity, the Middle to Late period transition is still considered a period of increasing social complexity that included craft specialization, increased control of production and distribution of trade items, and a shift in power from lineages to a few individuals (particularly in the northern Channel Islands) (Arnold 1987, 1992, 1993; Arnold and Munns 1994; King 1990). What still remains elusive is whether climatic factors influenced the islands' terrestrial and offshore environment, and how this drove (or did not drive) significant changes in social complexity on both islands. Furthermore, understanding the pace of this change on each of the islands is crucial in determining what role decreased or increased marine productivity had in these important social changes.

In addition to obtaining chronometric data, analyses of sites occupied during the Middle to Late period transition should focus on identifying the nature and types of activities carried out during this time. Understanding these types of activities, including domestic and ritual activities, will provide insight into underlying social structure and the level of social complexity. It will be necessary to compare these sites to those occupied prior to and following the transition to identify significant changes and continuity. Comparisons may reveal significant changes in resource exploitation that might reflect changes in resource availability (perhaps as a result of environmental perturbations) or changes in technology that may have allowed the islanders to exploit particular resources more effectively. Comparisons may also reveal significant changes in the relative abundance of exotic raw materials, perhaps reflecting variability in trade networks, differential access to limited resources, and other related variables.

5. What caused dramatic changes in population during the late Holocene?

Vellanoweth et al. (2002) used radiocarbon dating and settlement pattern data to identify several changes in population densities during the late Holocene on San Nicolas Island. They have argued for drops in population during three different time segments: 1300–1050 B.C., 550–300 B.C., and A.D. 200–450. Populations increased during four intervening time segments: 1050–800 B.C., 300–50 B.C., A.D. 450–700, and A.D. 1200–1450. The causes for these oscillations in occupation

density and possible associated environmental changes are not clear. Similarly, Raab and Yatsko (1998) discuss a possible dramatic decline in population during the late Holocene on San Clemente Island, starting around 800 RYBP. Placing these fluctuations in population within a regional temporal context is an important unresolved research issue.

Notably, it is important to investigate if these events were related to the Middle to Late period transition (A.D. 1100–1300; ca. 650–850 RYBP) drought era, and, in doing so, to consider the viability of modeling for a full or partial abandonment of the island during this time period. Continuing along these lines, another issue of importance is defining the population density on San Clemente during the proto-historic era, the period after initial European contact (A.D. 1542) and before colonization of southern California by the Spanish missions (A.D. 1769).

In addition to chronometric data, understanding the nature of these changes in population densities will require comparisons of sites occupied prior to and following these peaks and declines. Comparisons should focus on midden constituents, diagnostic artifacts, features, and other cultural attributes in order to identify any statistically significant changes that might have occurred around the time of these fluctuations. These population fluctuations should be examined with respect to resource availability, environmental fluctuations (changes in sea surface temperatures, drought, etc.), and related changes that may have occurred on the northern Channel Islands and the mainland. Comparisons should be made to determine whether these changes in population densities were localized events or part of broader regional trends.

6. Are there any diagnostic artifacts that are useful chronological markers?

Diagnostic artifacts (such as *Olivella* spp. shell beads and projectile points) are often important chronological indicators. Reinman and Townsend (1960) examined 112 projectile points from San Nicolas Island and identified seven types. They also examined 105 abalone shell ornaments and identified six key types (Reinman and Townsend 1960). Lauter (1982) analyzed projectile points, *Olivella* spp. shell beads, and other artifacts to identify an Intermediate period in San Nicolas Island. *Olivella* grooved rectangular (OGR) beads have been dated to 4,200 and 5,200 RYBP on San Clemente Island (Raab and Yatsko 1998). Another artifact that has the potential for being a temporal marker is the circular fish hook—Raab and Yatsko (1998) argue for an earliest use date of about 3,300 RYBP. Given this situation, some of the questions that remain unanswered include: What other diagnostic artifacts are useful chronological markers on San Clemente Island and San Nicolas Island? How do the time periods for these artifacts compare to typologies and chronologies developed for the other Channel Islands and mainland?

Efforts should focus on defining and refining artifact typologies and chronologies. This will require additional chronometric data and diagnostic artifacts from different site types occupied during different time periods. Particular emphasis

should be placed on examining projectile points and shell ornaments to determine what types are chronologically significant.

7. Can an obsidian hydration formula be developed for the islands?

Obsidian is not naturally found on San Nicolas Island or any other Channel Island, nor on the mainland coast (note that key obsidian sources are located at distinct inland locations). However, it has been recovered from archeological deposits and, therefore, was imported from the mainland, most likely through trade. Sourcing has revealed that much of the obsidian recovered from the island was obtained from eastern California, particularly from Coso Volcanic Field (Rick et al. 2001). Obsidian hydration, however, has not proven to be a useful chronometric tool considering that hydration results vary by source and are influenced by soil temperature and moisture, water percolation in the soil, surface exposure and direction of exposure, and even orientation of the artifact relative to the surface (Hall 1988).

What is the correction factor for obsidian hydration post depositional influences on San Nicolas Island? Determining a correction factor for obsidian hydration samples on San Nicolas Island requires obtaining paired radiocarbon assays and obsidian hydration measurements from a single depositional context. Obsidian samples then need to be sourced and hydration rims obtained. With this data, an island specific obsidian hydration formula can be developed. CA-SNI-16 and CA-SNI-25 on San Nicolas Island appear to be ideal sites on which to conduct obsidian hydration correction and correlation studies, given that obsidian samples from these sites have been previously sourced. Appropriate sites on San Clemente Island need to be selected.

4.1.2 Mainland (Sandy and Lagoonal Coast, Rocky Coast, and Inland Highlands)

In the last decade, extensive radiocarbon dating from a range of sites on Camp Pendleton has produced more than 200 radiocarbon dates (Byrd and Reddy 2002; Reddy 2004). Radiocarbon dating is much more limited for the rocky coast on Point Loma. Still, the relatively rich mainland data base allows us to move toward tracking the pace of change at a more sophisticated level, and define explicit questions for future research. Issues and questions are presented below that highlight significant gaps and immediate needs that will allow a clearer understanding of the timing of specific human behavior.

1. How can the lack of congruity in the use of chronological frameworks in San Diego County be resolved?

As discussed in Chapter 2, one of the severe limitations to coastal southern California archeological research is the lack of congruity in the use of chronological frameworks. Future research directives should limit the use of geoculture specific terms (San Dieguito, La Jolla, Pauma, Encinitas, San Luis Rey, etc.), and strive to use terms that would easily integrate cultural developments in the area to those in the mainland north and the islands. In this context, research should move toward the adoption of arbitrary chronological classification, perhaps based on calibrated

radiocarbon dates as proposed by Byrd et al. (2004) and Byrd and Berryman (2006) because this approach provides more detailed chronological resolution than the two- and three-period cultural frameworks typically employed.

2. What is the nature of early Holocene occupation (Paleoindian and Archaic), and how does it differ on the sandy and lagoonal coast versus the rocky coast?

Paleoindian sites or artifacts have not been documented in the Sandy and Lagoonal mainland coast, rocky mainland coast, and inland mainland highland landscapes under consideration in this project. Nonetheless, research has to rigorously examine the reasons for their absence rather than just equate lack of site discovery to lack of occupation. This requires regional geomorphological studies to reconstruct the coastline over time and development of specific field methods that are tailored to ascertain the potential for buried sites and sites that are below the sea level today (Reddy and Pope 2005). Systematic dating of low density shell scatters also has the potential to identify early occupations that lack obvious diagnostic indicators.

3. What is the likelihood of early Holocene occupation within the rocky coast landscape in the study area?

Given that rocky coast is the oldest type of coast in the study area (sandy beaches did not develop until about 5000 cal B.P. in San Diego County according to Masters [2006]), early Holocene human adaptations would have had to be tailored to the rocky coast landscape, especially in the southern part of San Diego County. What is the frequency of San Dieguito artifacts and sites within rocky coastal landscapes as opposed to sandy and lagoonal coastal landscapes? This research issue has some limitations because sea level has changes, and the ancient shoreline (which may contain early sites) is not the same as in the past.

4. How can the coastal/inland dichotomy of the Archaic period be reevaluated?

The Archaic period coastal/inland dichotomy as proposed by Bull (1987), Gallegos (2006), and Moratto (1984), among other, needs systematic reexamination and reevaluation. On the coast, Archaic period occupations were concentrated along lagoons and estuaries where populations had access to abundant marine, tidal, lagoonal, and terrestrial resources. In the inland, the sites are located in river valleys and within oak woodland habitats. Considerable research is necessary before we can make any reasonable interpretations about whether the inland and coastal components of the Archaic period are contemporaneous and seasonal counterparts, or contemporaneous (but distinct) cultures. Efforts should focus on rigorous radiocarbon dating from a range of sites (small and large occupations) and seasonality studies.

5. Where does the rocky coast landscape fit in the Archaic period coastal/inland dichotomy debate?

In the ongoing debate on whether the Archaic period occupations along the sandy and lagoonal coast are seasonal coastal components or camps contemporaneous to

inland highland populations, the role of the rocky coast landscape is overlooked. It is important to consider how this landscape fits with the two competing models.

6. Were rocky coast landscapes used as intensively as sandy and lagoonal coast landscapes during the Late Archaic and Late Prehistoric periods?

There is overwhelming evidence of intensive exploitation of the sandy and lagoonal coast landscape in the Late Archaic and Late Prehistoric periods. Future research should delineate the intensity of use of the rocky coast landscape during these time periods and how it compares to use of the sandy and lagoonal coast.

7. Was there a change in the organization of the population at the onset of the late Holocene?

At the onset of the late Holocene (about 3,500 years ago), there was a meaningful reorganization in the settlement system along coastal northern San Diego County within the sandy and lagoonal mainland coast landscape. Some parts of the coastal lagoonal landscape, such as Batiquitos Lagoon, appear to have been abandoned, with populations moving south and east (Gallegos 1985; Warren 1964). In contrast, other portions of the area, such as the Red Beach area on Camp Pendleton, had continued and intensive occupation into the subsequent period (Byrd and Reddy 1999, 2002; Reddy 1999). This was very likely due to varied microniche changes in the paleoenvironment of the different lagoons and local drainages that were specific to each lagoon. This resulted in negative environmental change to areas and no declines in resource availability other areas. Future research efforts should attempt to refine these issues through rigorous dating, targeted subsistence studies, and geomorphological reconstructions.

8. What caused dramatic changes in population during the late Holocene?

The late Holocene witnessed significant changes in population densities on the mainland coast. Currently, we need more accurate data on the pace of these changes and if oscillations in population density occurred (as documented on the islands). Byrd and Reddy (2002) and Reddy (1999) have suggested that occupational density on Camp Pendleton increased after 700 A.D., based on the proliferation of small, coastal sites. Population movement to the south and east due to declining environment around certain lagoons could conceivably be a causal factor in these changes (Gallegos 1985, 2006; Warren 1964). This would fit with the findings of Byrd (1998), Byrd and Reddy (2002), and Reddy (1999), which indicate that environmental change was not uniform along the coast. Future research should be geared to address this issue in the context of sandy and lagoonal mainland coast landscapes.

Chronometric data is critical to addressing these research questions. In addition, comparisons of sites occupied prior to this time period would be of great importance, particularly with respect to occupation during the middle Holocene drought. Comparisons should focus on midden constituents, diagnostic artifacts, features, and other cultural attributes to identify any statistically significant changes that might have occurred around the time of change in population densi-

ties. Of importance would be determining whether these changes in population densities were localized events or part of broader regional trends.

9. Did similar changes occur during the Protohistoric era?

Along similar lines an issue of great importance is defining the population density along the coast during the protohistoric era, the period after initial European contact (1542 A.D.) and before colonization of Southern California by the Spanish missions (1769 A.D.). Currently, population densities are not well understood for this short time segment. There has been a lot of debate on whether Native American villages were present before colonization or the coast was abandoned.

4.2 Theme: Paleoenvironmental Influences on Culture

Paleoenvironmental changes had a direct and irreversible effect on human behavior across the globe. In this light, two of the most striking changes to impact humans were the terminal Pleistocene/early Holocene postglacial rise in sea level, and trans-Holocene sea surface water warming and cooling trends. In the discussion below, potential effects of these changes on prehistoric coastal California inhabitants will be explored through a series of research questions regarding the islands and the mainland. Research issues related to paleoenvironmental influences on culture are distinct for the islands and the mainland and are therefore addressed separately. However, research questions for two mainland landscapes (sandy and lagoonal coast and rocky coast) are collapsed into a single category because they are shared by all three landscapes. No research questions are presented for the inland highlands landscape.

4.2.1 Islands

Over the past 10,000 years, the paleoenvironment of southern California has dramatically changed. Prior to the melting of continental glaciers at the end of the Pleistocene, sea levels were much lower, and the northern Channel Islands were connected as single landmass now known as Santarosae. During this time, the southern Channel Islands were closer to the mainland, though they were never connected as a single landmass. Between 5,000 and 9,000 years ago, melting of continental glaciers caused sea levels to rise approximately 2–3 cm annually, if not faster (Schneider 1997). For example, recent paleoenvironmental reconstructions suggest that much of San Nicolas Island was inundated as a result of rising sea levels; the island was over three times larger at 11,000 B.P. and almost 25 percent larger around 8500 B.P. (Pierson et al. 1987). Rising sea levels dramatically changed the coasts of San Clement Island and San Nicolas Islands. The coastlines were pushed farther inland as waves cut new terraces and transformed former terraces into cliffs. In coastal areas with adequate supplies of sand, sandy beaches formed and in some cases, were reworked into coastal dunes (Maxwell et al. 2007). Along the northwest coast of San Nicolas Island, a shallow marine terrace was inundated, transforming a series of highly productive intertidal networks into prime kelp forest habitat. Between 5000 and 3000 B.P., the rate of sea level rise slowed and reached current levels (Inman 1983).

Paleoenvironmental reconstructions indicate that, in addition to rising sea levels, other climatic changes occurred during this time. A growing body of palynological, isotopic, and tree ring data suggest that, between 8,000 and 10,000 years ago, the climate was much cooler and moister (Heusser 1978; Pisias 1978). This was followed by a period of warmer and drier conditions known as the Altithermal, which lasted until approximately 5,000 years ago (Antevs 1955). A study of oxygen isotopes indicates environmental fluctuations were particularly dramatic during the past 3,000 years. Sea surface temperatures were relatively warm and stable between 3000 and 1550 B.P.; however, the period following this was marked by cold and unstable sea surface temperatures that lasted until 700 B.P. (Boxt et al. 1999; Kennett and Kennett 2002). Recent palynological studies on San Nicolas Island suggest that there were two periods of relatively dry conditions in the late Holocene: 1250–1375 B.P. and 420–920 B.P. (Davis et al. 2003). Wet and cool conditions preceded each of these intervals. Considering that humans were intricately connected to their environment, paleoenvironmental changes undoubtedly had a dramatic impact on human populations and culture. Future studies should focus on clarifying paleoenvironmental influences on culture, and this research should include the following research issues.

1. What were the environmental conditions when humans first occupied the islands, and what resources were available to early islanders?

Considering that the coastlines of both islands have dramatically changed over time as has the availability of resources, addressing this research issue will require continued efforts to reconstruct the islands' paleoenvironment. These should focus particularly on sea surface temperatures and other climatic conditions. Paleoenvironmental reconstructions will help determine what types of resources were most likely available to early islanders. In addition, midden constituents from sites occupied in the early Holocene should be analyzed and compared to dietary reconstructions for sites occupied later in time, particularly during the early portion of the middle Holocene. Significant differences in midden constituents may reflect changes in resource availability as a result of paleoenvironmental influences. Such analysis has been done at Eel Point (CA-SCLI-43) on San Clemente Island, but that is the only site on the island that has been the subject of such intensive research.

2. How have environmental perturbations influenced human occupation of the islands?

As mentioned above, paleoenvironmental reconstructions indicate that there have been numerous periods of warm and dry and cool and moist environmental conditions. Addressing the impact of the fluctuations on human adaptations will require paleoenvironmental reconstructions and chronometric data. Sites occupied prior to and following each climatic episode should be analyzed and compared, focusing on settlement locations, population density, dietary reconstructions, technology, and other cultural attributes that might reflect changes that were influenced by fluctuating environmental conditions.

3. Were islanders and mainlanders differently impacted by the environmental conditions discussed above?

Sites on San Clemente Island, San Nicolas Island and the coastal mainland occupied during the key environmental episodes discussed above should be compared, focusing on population density, settlement and subsistence patterns, technology, trade, and social organizations. Significant differences and similarities between island and mainland sites will help characterize how these different populations adapted to fluctuating environmental conditions and how they may have interacted with one another during periods of favorable and adverse environmental conditions.

4.2.2 Mainland Coast (Sandy and Lagoonal and Rocky)

The paleocoastline of the mainland was dramatically different from the coastline of today. Fast paced, sea level rise during the late Pleistocene and early Holocene shifted the shoreline eastward, resulting in inundated valley floors and the creation of steep and narrow bays in some areas (Byrd 2004; Inman 1983; Kern 1995; Masters 1994; Orme 1993; Waters 1996a, 1996b). When the marine transgression slowed in the middle Holocene (ca. 6000–3000 B.P.), coastal estuaries, lagoons, and sandy beaches began to be established (Nardin et al. 1981). This rise in the sea level ultimately resulted in aggradation in some estuaries and the silting of some lagoons. The shoreline continued to retreat in the late Holocene with the erosion of coastal cliffs by sea wave action (Inman 1983; Kern 1995). Two major research topics have been delineated for paleoenvironmental studies of the coastal mainland.

1. How did changes in the mainland coastline impact cultural adaptations?

In this context, important issues to explore are the establishment of coastal estuaries and then sandy beaches in the middle Holocene (6000–3000 B.P.) and the rise in sea level and aggradation/silting of estuaries. Additional research is needed to link the ecological histories and formation of important lagoons and freshwater coastal alluvial environments with human adaptive changes to sandy and lagoonal landscapes. This requires detailed studies linking coastal reconstructions to local cultural adaptations, and detailed studies of settlement and subsistence patterns similar to those undertaken by Byrd (1996, 2003, 2004, 2005), Reddy (1999, 2004) and York et al. (1999) on Camp Pendleton.

2. Did first inhabitants have more access to rocky coast landscapes, given that they were more prevalent in the late Pleistocene/early Holocene?

Given that rocky coast landscapes were more prevalent in the early Holocene, it is important to address whether prehistoric occupation of the rocky shoreline may provide a means by which we can model the types of resources exploited and the settlement pattern of early inhabitants. The rocky coast landscape would provide a more accurate context relative to the early occupation of sandy shorelines.

3. Are there any sites and/or ground stone isolates offshore along the mainland coast that can be used to model human occupation along the paleocoastline?

Over the years, divers have recovered numerous prehistoric artifacts from various locations that are presently submerged off the San Diego coast. These recoveries raise intriguing questions about their potential deposition during the Pleistocene or early Holocene, when sea level was substantially lower than at present and the coastline lay substantially farther west. Hudson (1976) has located isolated stone bowls and bowl fragments offshore in moderate to shallow waters (15.2 m) due west of Old Point Loma Lighthouse. More recently, Masters (1983) has identified about 34 submerged “sites” with one to three artifacts each off the coast in San Diego County (Masters 1983). The artifacts were found as deep as 30 m and as far as 800 m west of the present shoreline. They included stone bowls, manos, metates, pestles, net weights, scrapers, and projectile points. The stone bowls are typically made from friable sandstone.

Future archeological investigations should date these artifacts, and conduction studies should be performed to interpret their functions and use. Furthermore, underwater studies may be applied to determine whether these artifacts are associated with nearby in situ features (hearths or related features). There is an eminent need to conduct standardized scientific studies to identify manufacturing techniques, use wear, postdepositional damage, and, conceivably, even organic residues (if there is a sufficient level of preservation).

4. Did the Medieval Climatic Anomaly disrupt coastal mainland settlement?

The second research issue is centered on the Medieval Climatic Anomaly (A.D. 800–1400); there has been much debate about the extent of its impact. Paleoclimatic records from a wide variety of contexts have consistently indicated that the period between 1,000 and 700 years ago (A.D. 1000–1300) was characterized by generally higher temperatures and periods of extreme drought. This event, known as the Medieval Warm Period or the Medieval Climatic Anomaly, has received considerable attention in archeological literature.

The apparent severity of the droughts and their potential coincidence with important cultural changes apparent throughout the prehistoric archeological record of California (Raab and Larson 1997) has lent considerable interest to this topic. In particular, Larson and Michaelson (1989) have argued that the interval between A.D. 1100 and 1250 was one of continued drought, particularly between about A.D. 1120 and 1150. Raab and Larson (1997) have tentatively linked these periods to contemporaneous increases in interpersonal violence, declines in health, decreases in population, and occupational hiatuses in the archeological record. Similarly, scholars have attributed to these disruptions an important role in the emerging cultural complexity among Late Prehistoric hunter-gatherers in coastal southern California (Kennett and Kennett 2000; Raab and Larson 1997). At a more general level, Jones et al. (1999) have argued that the Medieval Climatic Anomaly had profound impacts on hunter-gatherer settlement throughout California. Little research has been conducted on this topic along the southern California

mainland coast. Byrd and Reddy (2002), however, noted that major residential sites continued to be occupied on the central Camp Pendleton coastal landscape during this time period, but that other site types become rare. After the Medieval Climatic Anomaly, however, specialized sites became widespread, suggesting that populations increased in this area. Research issues and methods should be developed that will target evidence for persistent drought conditions and the timing of climatic change across the landscapes linked to changes in settlement patterns.

4.3 Theme: First Inhabitants

The question of the first inhabitants in California has been the subject of much debate for several decades. Archeological contexts in California, particularly the northern Channel Islands, contain some of the earliest evidence of human occupation in the Americas. Currently, for the SDSSCAR region, the earliest date of occupation in the southern Channel Islands is from San Clemente Island and suggests peopling of the island by 6550 cal B.C. in the early Holocene (Raab and Yatsko 1992). CA-SNI-339 on San Nicolas Island has the same date, but it lacks solid contextual control, and the most substantial evidence on the island is from the middle Holocene (Vellanoweth et al. 2002). On the mainland, Camp Pendleton's earliest occupation with strong contextual control is slightly earlier than the earliest on the southern Channel Islands (6700 cal B.C. from CA-SDI-12568) (Collett and Bull 2005). A much earlier date of 8720–8200 cal B.P. was also obtained from the same site on Camp Pendleton, but there are no associated artifacts in the context. Research issues related to first inhabitants are distinct for the islands and the mainland for a variety of reasons. Therefore, the island and mainland landscapes will be addressed separately. Research questions for two mainland landscapes (sandy and lagoonal coast and rocky coast) are collapsed into a single category because they are shared by all three landscapes. No research questions are presented for the inland highlands landscape.

4.3.1 Islands

In contrast to the southern Channel Islands and the southern mainland coast, the nearby northern Channel Islands have yielded much earlier early Holocene dates for human occupation (ca. 9000 B.C.). This includes radiocarbon dates from Daisy Cave on San Miguel Island (Erlandson et al. 1996) and Arlington Springs on Santa Rosa Island (Johnson et al. 2000). Human skeletal remains from the Arlington Springs site on Santa Rosa Island have been dated to the terminal Pleistocene, approximately 13,300 years ago (Johnson et al. 2000). Daisy Cave on San Miguel Island has provided additional evidence of early human occupation dating to approximately 13,000 years ago (Erlandson et al. 1996).

In general, the earliest occupation of the northern Channel Islands is characterized by small sites that reflect short-term maritime activities and ephemeral occupation. Early inhabitants collected shellfish and a variety of fish species from rocky shore and kelp bed habitats. Kennett and Conlee (2002) have argued that people

continued to use the outer islands (including the southern Channel Islands) only sporadically during the early Holocene.

Earliest occupation of the two islands in this study is about 8,000 years, based on evidence from the Eel Point site (CA-SCLI-43) on the Coastal Terrace in western San Clemente Island and CA-SNI-339 on the southern coast of San Nicolas Island. Vellanoweth et al. (2002), however, suspect that this early date from CA-SNI-339, lacks solid contextual information. According to Martz (2005) there are two other sites on the island with evidence of early Holocene occupation. Both sites are characterized as residential habitations; one is located on the island's plateau (CA-SNI-351) and the other along the west end (CA-SNI-11). Other sites on San Nicolas Island may have been occupied during the early Holocene and, perhaps, the terminal Pleistocene, but have since been inundated by rising sea levels. On San Clemente Island, much of our understanding of early occupation is based on the work at Eel Point (CA-SCLI-43), which, though noteworthy and exemplary, still only provides a single site perspective. Future research efforts should focus on addressing the dearth of early Holocene evidence.

1. When were the islands first occupied?

Determining earliest occupation of the islands will require extensive chronometric data from potential early sites across the islands. Considering that much of both islands were inundated as a result of rising sea levels, underwater archeological investigations have the potential to locate submerged archeological sites. Examining bathymetric data, and coastal formation processes, as well as island settlement pattern distribution, may help to create a predictive model, which highlights areas surrounding the island that potentially contain inundated early archeological sites.

2. What is the nature of the earliest island occupation?

Based on the presence of large hearths and distinctive living floors, Raab and Yatsko (1998) and Yatsko (2000) suggest that the Eel Point site (CA-SCLI-43) on San Clemente was much more sedentary in the early Holocene than most researchers generally attribute to early Holocene occupation in the region. Of course, settlement permanence was substantially higher in the middle Holocene (as noted at the Nursery site [CA-SCLI-1215] on the island), based on data from semisubterranean structures. Martz (2005) has identified three sites occupied during the early Holocene on San Nicolas that may have similar evidence of hearths and living floors. However, the exact nature of these occupations is still unknown, and seasonality data that can contribute to resolution of some of the speculation is limited.

Research efforts should focus on these sites as well as on any others reflecting early Holocene or terminal Pleistocene occupation. Archeological investigations should, in particular, examine seasonality of occupation, midden constituents (to determine the types of resources early islanders exploited), technology, and diagnostic artifacts. Comparisons of these early sites with those occupied during the middle Holocene will help identify significant differences and similarities in occupation that may provide insight into the peopling of the Americas and early maritime adaptive strategies.

4.3.2 Mainland Coast (Sandy and Lagoonal and Rocky)

Of particular interest is the recent debate regarding though which route California was first settled: down the coast or via an inland route. Regarding the Paleocoastal route, the major debate in the area of San Diego Archeology is whether the San Dieguito is an element of a broader coastal adaptation, or if it is a distinct culture indicative of populations from inland regions. Site detection and site preservation is a particularly important issue to consider in this discussion of first inhabitants of the coast. Also, in the haste to look for early Holocene settlers, the potential validity of modeling for delayed settlement of particular landscapes over others has not been seriously considered. In other words, early inhabitants may have concentrated on certain settings and ignored others. Identification of such selective criteria would aid the search for additional early sites in the region.

The earliest radiocarbon dates for settlement of coastal landscapes in Orange and San Diego counties are ca. 8000–7000 B.C.—significantly later than those for San Clemente and San Nicolas Islands (Byrd 2003; Byrd et al. 2004; Gallegos 1991; Koerper et al. 1991). This leads us to ask whether the settlement of the mainland southern coast could have been delayed whether early sites have not been detected/preserved, or whether appropriate methods of detection for early sites have been applied.

4.4 Theme: Settlement Patterns

The mobility strategies and settlement patterns of prehistoric hunter-gatherers in coastal southern California are not well understood (Jones 1992; Lightfoot 1993). The following research issues will be addressed: settlement location on the landscape continuity and change in residential mobility and the size, density, nucleation, and dispersion of settlements. Research issues related to settlement patterns are distinct for the islands and the mainland; therefore, they will be discussed separately. Research questions for the three mainland landscapes (sandy and lagoonal coast, rocky coast, and inland highlands) are collapsed into a single category because they are shared by all three landscapes.

4.4.1 Islands

Settlement pattern studies of the southern Channel Islands have addressed the coastal/inland dichotomy and suggested that the coast was used initially by highly mobile populations, with a shift to sedentary maritime adaptations in the later periods (Erlandson 1994; Grenda 1997). Currently, the relative degree of settlement permanence and how annual systems incorporated coastal and inland resource exploitation remain poorly understood. Delineating how prehistoric populations arranged themselves around a changing food resource base is important. How populations organized themselves with respect to vital resources also provides critical information about their economic practices and social organization. Some of the questions that have not been resolved regarding Island and San Nicolas Island include:

- What was the nature of the settlement pattern on the islands during the early Holocene, particularly in terms of the dynamic range of adaptations between simple “foraging” and complex “collecting”?
- How did the exploitation of inland and coastline setting change during the Holocene, and how were these changes reflected in settlement pattern organization?
- Sedentary communities appear to have flourished in the middle Holocene on San Clemente Island. Were similar communities present on San Nicolas at this time? What are the implications for settlement pattern organization on San Clemente if the Nursery site (CA-SCLI-1215) and Eel Point (CA-SCLI-43) are considered large sedentary communities that were the focal point of the social system?
- During the late Holocene, San Clemente Island witnessed a change in settlement pattern in response to climate flux (Yatsko 2000). It is highly likely that the island’s sources of fresh water may have been significantly altered during this time period. Data is needed to assess the relationship between freshwater sources and site location (Raab and Yatsko 1998) and how this may have changed over time.
- Does San Nicolas Island have a similar bifurcate settlement system with extraction sites and base camps (e.g., the Eel Point site, CA-SCLI-43), as has been suggested for San Clemente Island (Raab and Yatsko 1998)?
- Was there a proliferation of small sites, residential sites and other specialized sites on San Clemente Island during the last 1,000 years, as suggested by Byrd and Raab (in press). Does this pattern have similarities to mainland coastal developments (Byrd and Reddy 2002), and did it also occur on San Nicolas Island?

4.4.2 Mainland (Sandy and Lagoonal Coast, Rocky Coast, and Inland Highland)

On Camp Pendleton, the early periods of occupation were characterized by a forager strategy, whereas the Late Prehistoric period may have had residential bases with a complex settlement organization (Byrd 1998; Byrd and Reddy 1999, 2002; Reddy 1999, 2004). Alternatively, given the potential for adequate storable resources, the Late Prehistoric period may have had a logistically organized collector strategy with a strong seasonal component, which included fall and winter in the highlands and other periods on the coast (Bean and Shipek 1978). Interpretations of coastal settlements have varied from year round settlement (Howard 1977) to multiple season occupation with minimal winter representation (Byrd and Reddy 2002) to highly seasonal occupation (Woodman 1996a). Four research areas are discussed below.

1. How did settlement patterns in the rocky coast and sandy lagoonal coast landscapes vary in the Archaic and Late Prehistoric periods?

The nature of the Archaic period coastal settlements (San Dieguito and La Jolla) versus the inland (Pauma) settlements in the sandy lagoonal versus rocky coast landscapes remains unresolved primarily because of the lack of robust data from inland sites.

2. Was there any change in settlement patterns on rocky coast landscapes associated with the Medieval Climatic Anomaly?

Models have been offered for the sandy and lagoonal coast landscape that suggest that there was an increase in population after the Medieval Climatic Anomaly (Byrd and Reddy 2002; Jones et al. 1999). Although considerable research is needed to determine the validity of these models, it is important to address whether such a correlation is observed in the rocky coast landscapes. Research should target evidence that indicates persistent drought conditions in this particular landscape.

3. Is there a seasonality component in the late prehistoric period settlement systems with a coast/highland dichotomy?

Given the potential for adequate storable resources, the Late Prehistoric period may have had a logistically organized collector strategy with a strong seasonal component, which entailed fall and winter in the highlands and multiple seasons on the coast (Bean and Shipek 1978). Coastal sites on Camp Pendleton have yielded seasonality data (macrobotanical remains, phytoliths, fish otoliths, and seasonally available fish) that suggest multiple seasons of occupation (e.g., Byrd et al. 1995; Byrd 1996a, 2003; Byrd and Reddy 2002; and Reddy et al. 1996). Typically, spring, summer, and fall indicators are common on these coastal sites. Future research should continue this trend of gathering seasonality information for coastal and inland sites. In particular, appropriate recovery methods should be employed to retrieve fish otoliths and macrobotanical remains that provide crucial seasonality data.

4. Was there a change in settlement systems after cal a.d. 800?

Study of settlement patterns on Camp Pendleton has demonstrated a diachronic trajectory beginning in A.D. 700 (Byrd and Reddy 1999; 2002). This trajectory involved an increase in site density and an increase in the types of specialized sites and residential bases. This pattern was interpreted as the emergence of a complex settlement pattern with major residential bases along key drainages and more specialized sites clustered around them, similar to Binford's (1980) radiating organizational strategy (Byrd and Reddy 1999; 2002). A similar bifurcate settlement system with extraction sites and base camps (e.g., the Eel Point site, CA-SCLI-43) was constructed for Late period San Clemente Island (Raab and Yatsko 1998). Additional research is necessary to explore whether such reorganization was a more widespread pattern, in varied mainland landscapes.

5. Were rocky coast landscapes of sufficient size for complex spatial organization to develop, especially in the Late Prehistoric period?

In some rocky coast landscapes, such as Point Loma, the width of Pleistocene terraces constituted spatial constraints on how elaborate a settlement pattern could get. It is important to model whether the physical topography and character of the landscape may have had a direct influence on cultural development—particularly, the evolution of complex organization, with residential camps and logistical processing camps. Furthermore, if there was such a constraint, how cultures adapted and addressed this challenge is an important research question.

4.5 Theme: Subsistence Systems

Recent research on subsistence issues in coastal southern California has explored the dynamics of paleoenvironmental change and resource intensification (Altschul et al. 2005; Broughton and O'Connell 1999; Byrd and Reddy 2002; Douglass et al. 2005; Jones et al. 1999; Raab 1996; Reddy 1999). In doing so, it has moved dramatically away from traditional reconstructions of prehistoric hunter-gatherer adaptations such as those offered by Bean and Lawton (1976), King (1990), and Moratto (1984). For example, Bean and Lawton (1976) and Shipek (1989) argued that southern California foragers were "quasi-agriculturalists" because of their extensive use of acorns. Recently, Reddy (1999; 2004) has advocated a reevaluation of their models based on the absence of acorn remains in macrobotanical assemblages from archeological sites on the coastal and inland areas of the San Diego region. Given the range of marine and terrestrial habitats (sandy, rocky, and highlands) represented in the four landscape categories in this study, appropriate research questions include the range of adaptations represented, long term change, and correlations between changes in subsistence and the paleocoastline.

The discussion below presents subsistence questions for the different landscapes (islands and mainland), but there are two research issues applicable to both the islands and the coastal mainland. First, what is the long term trajectory for potential overexploitation of high ranked food resources as it relates to resource intensification? This situation may have led to resource depletion and a shift to more costly resources (Broughton and O'Connell 1999) and is an important research question for the islands and the coastal mainland. To address this issue, a range of food resources should be studied, including plants, shellfish, fish, sea mammals, and terrestrial mammals. Second, the role of costly signaling in relative exploitation of small versus large meat packages is particularly relevant to the coastal mainland landscapes and southern channel island landscapes (Broughton and O'Connell 1999). In addressing these issues, one must also consider the assertion (Jones et al. [1999]) that the severe, medieval era drought had a particularly devastating effect on coastal California hunter-gatherers because of their increasing reliance on stored foods and loss of foraging efficiency.

Research issues related to subsistence systems are distinct for the islands and the mainland; therefore, they will be discussed separately. However, research questions for the three mainland landscapes (sandy and lagoonal coast, rocky coast and inland highlands) are collapsed into a single category because they are shared by all three landscapes.

4.5.1 Islands

People have been drawn to the southern Channel Islands for thousands of years, despite the islands' arid environment, limited terrestrial resources, and considerable distance from the mainland and neighboring Channel Islands. Early occupants focused on collecting shellfish, fishing, and hunting sea mammals. Recent paleodiet studies indicate that San Nicolas Islanders subsisted predominantly on marine resources (Harrison and Katzenberg 2003). Additionally, marine resource

consumption does not appear to have decreased over time on San Nicolas as compared to other channel islands and the mainland (Goldberg 1993; Harrison and Katzenberg 2003).

On San Clemente Island, subsistence orientation in the early Holocene is probably the least understood, primarily because of a lack of data—Eel Point (CA-SCLI-43) being the only early Holocene site on the island. One issue that has been a consistent topic of debate is the relationship between resource intensification and declining foraging efficiency on the island during the Holocene (Porcasi et al. 2000; Raab 1996; Raab and Yatsko 1992; Yatsko 2000). However, much of the data for this discussion is from Eel Point (CA-SCLI-43), and there is a clear need for data from a wider range of sites on the island. Overexploitation of specific marine resources, such as sheep head (Salls 1988), and abalone (Garlinghouse 1995; Raab 1996; Raab and Yatsko 1992), has been noted at Eel Point (CA-SCLI-43). This overexploitation resulted in reliance on smaller food packages, such as *Tegula* sp. (small gastropod), in the late Holocene. These findings have significant implications for reconstructing settlement and subsistence patterns on San Clemente. However, they are based largely on work at Eel Point (CA-SCLI-43), and additional data from other sites is necessary.

On San Nicolas Island, as mentioned previously, Rogers's (1993) early work noted changes in midden constituents over time, noting that land snails predominated in early components, whereas later deposits appeared to contain concentrations of red and black abalone. This pattern is the opposite of that documented on San Clemente Island. Reinman (1964), who examined midden constituents from CA-SNI-16, a site located on the north coast and occupied between approximately 2290 and 790 B.C., noted that the types and relative abundance of shellfish species varied between the site's four mounds. Reinman (1964) hypothesized that each mound reflected a different period of occupation and resource exploitation focus. When a preferred resource was over exploited, Reinman (1964) suggested, the islanders abandoned the site and returned later, occupying a slightly different location or mound. Reinman (1964) theorized that, because certain shellfish species populations did not have enough time to recover, the occupants of CA-SNI-116 were forced to harvest alternate species, as reflected in the different shellfish compositions of the mounds. More recently, Vellanoweth and Erlandson (1999) examined midden constituents from CA-SNI-161; a site situated on the northwest coast and periodically occupied between the middle and late Holocene. Dietary reconstructions suggest that fish were the most important source of animal protein (54 percent) followed in frequency by shellfish (32 percent), sea mammals (14 percent), and birds (less than 1 percent) (Vellanoweth and Erlandson 1999). Vellanoweth and Erlandson (1999) point out, however, that the importance of sea mammals may be underrepresented in their study considering sea mammals provided not only food resources, but nonfood components as well, including fuel oil, bones for tools and shelter, and hides for clothing and shelter.

The role of plants in the islanders' subsistence base is relatively unknown. A few macrobotanical remains have been recovered from CA-SNI-351 on San Nicolas island, a site situated on the island's plateau and occupied during the middle and

late Holocene. A variety of different types of seeds have been recovered, including wild cucumber (*Marah* spp.), red maids (*Calandrinia* sp.), legume family (Fabaceae), Manzanita (*Arctostaphylos* sp.), and, possibly, blueberry or huckleberry (*Vaccinium* spp.) (Thomas 1995). Additionally, one bulb (Brodiaea) was recovered. A pollen wash of a ground stone fragment revealed the tool might have been used to process *Chenopodium*, *Amaranthus*, or possibly Poaceae seeds (Cummings 1993). Many of these types of plants do not grow locally on San Nicolas Island and consequently, were likely imported from neighboring regions. On San Clemente island, there is a significant data gap when it comes to documentation of prehistoric plant food use. With the exception of limited paleoethnobotanical studies (Eisentraut 1996; Hildebrandt and Jones 1997; Klug and Popper 1997; Reddy 2000b, 2000c, 2002; Wertman 1959), the focus of the subsistence research has been on faunal remains. A total of 23 sites on San Clemente Island have been sampled for carbonized seeds. A variety of different types of seeds have been recovered, including *Atriplex* sp., *Calandrinia* sp., *Chenopodium* sp., *Echinocactus* sp., a range of legumes, and a range of grasses. In general, *Chenopodium* sp. has the highest ubiquity and also dominates the assemblage.

Although considerable work has previously been done examining subsistence systems on San Clemente and San Nicolas Islands, there are numerous research avenues that still need to be addressed, particularly with respect to how subsistence patterns changed over time and the factors that may have precipitated these changes.

1. What types of resources were targeted during the early, middle, and late Holocene?

Addressing this research issue will require analyzing midden constituents from sites occupied during each Holocene phase, including sites with single and multiple components. Comparisons between sites may reveal significant differences in the types of resources exploited over time.

2. How do the late Holocene environmental perturbations coincide with changes in subsistence patterns?

Paleoenvironmental reconstructions have revealed numerous environmental perturbations, particularly during the late Holocene. Research efforts should focus on comparisons of midden constituents and dietary reconstructions from sites occupied prior to, during, and following these periods of major climatic change. Additionally, comparisons of tool kits over time may reveal significant technological changes, particularly with respect to those designed to adapt to changing environmental conditions.

3. Is there evidence for a change in the exploitation of particular shellfish or other types of resources over time on San Nicolas Island?

On the northern Channel Islands, there is evidence of a switch in emphasis from exploitation of abalone to California mussel (*Mytilus californianus*) (Glassow et al. 1988). Similarly, on San Clemente Island, there is a switch from abalone to *Tegula* sp. (Raab and Yatsko 1992, 1998). This change in emphasis is attributed

to the overexploitation of abalone beds forcing islanders to use an alternate resource (Glassow et al. 1988; Raab 1996). Is there similar evidence of overexploitation of certain shellfish species or other types of resources on San Nicolas Island? Could two distinct exploitation systems be in play at the two islands—San Nicolas islanders alternating exploitation of particular shellfish based on fluctuations in the local shellfish populations, and the San Clemente islanders changing their subsistence system entirely?

The relative abundance of different shellfish species, as well as other types of resources, in sites occupied during different time periods and on different parts of the island will need to be examined. Comparisons of these sites may reveal significant changes in the types of resources that islanders exploited. The timing of changes should be compared with the timing of periods of known environmental perturbations to help clarify whether changes in resource utilization reflect overexploitation or diminished resource availability due to climatic changes.

4. Is there evidence of food storage on San Clemente and San Nicolas Islands?

Addressing this research issue will require identifying and examining features that were likely used for food storage. Emphasis should be placed on when the site was occupied, where the site is located, the types of constituents found within the food storage feature, and the types of food resources recovered from the site in general. Chronometric data may reveal that food storage was important during certain times in prehistory, particularly during periods of environmental stress or rapidly growing population density. This topic could also benefit from theoretical modeling of seasonal needs, potential storable resources, and expected strategies.

5. What types of food resources were imported to San Clemente and San Nicolas Islands, and how dependent were the islanders on these imported food resources?

Arnold (1992) has argued that late Holocene northern Channel Islanders traded finished goods, such as shell beads, for mainland foods, including plant foods such as acorns. If this model can be extended to the southern Channel Islands, then these island sites may yield evidence for nonlocal plants, seeds, and nuts. It should, however, be noted that Arnold's (1992) model has yet to be empirically verified. Efforts should focus on analyzing the types and relative abundance of flora and fauna food resources that were not locally available on the island. Significant changes in the types and relative abundance of such resources may reveal that imported resources were more important during certain periods of prehistory, particularly during periods of environmental stress. Additionally, determining where these imported resources may have originated will help to delineate trade networks and characterize past cultural interactions.

4.5.2 Mainland (Sandy and Lagoonal Coast, Rocky Coast, and Inland Highlands)

Subsistence issues are closely tied to settlement systems, and these are much more pronounced in coastal southern California. Interpretive models for prehistoric ad-

adaptations in southern coastal California have ranged from overexploitation of high ranked resources to resource depletion to resource intensification focusing on costly resources—all important research avenues to pursue. In understanding subsistence orientation, the range of adaptations represented, long term change, and correlations between changes in subsistence and the paleocoastline should be considered. Review of the literature relevant to the coastal mainland and inland landscapes in this study area resulted in the articulation of five main research avenues.

1. Why did the early Holocene (Archaic period) and Late Prehistoric coastal populations not exploit sea mammals?

Small, terrestrial mammals are typically the primary mammals represented in the early Archaic coastal sites on Camp Pendleton. The only exceptions to this trend are three sites (CA-SDI-13325, CA-SDI-811 and CA-SDI-14522) with late Archaic Period occupations, which have some marine mammals (seals and sea otters) (Byrd et al. 1995; Reddy 1999; Wake 1999). Late Prehistoric sites have no marine mammal remains. Possible explanations include the absence of suitable locations for sea mammal rookeries and a brief shift to maritime adaptations due to social factors currently not well defined.

2. How intensive was the exploitation of sea mammals in the rocky coast landscape? How does this exploitation compare to that observed on the sandy and lagoonal landscape?

In contrast to the sandy and lagoonal landscape, where sea mammal exploitation was minimal, there is strong evidence for maritime subsistence on the bay side of Point Loma, as observed at CA-SDI-48 (Gallegos and Kyle 1998) and CA-SDI-10945 (Pignuolo et al. 1991). Future research should model the relative intensity of this exploitation as compared to that in the sandy and lagoonal landscape.

3. What were the Transitional Period II milling tools used for along the coast and inland?

The Transitional Period II (San Dieguito–La Jolla) associated with milling tools, but there has been no direct evidence of the use of these tools for particular resources (e.g., plants, coastal resources, etc.). The Archaic period stone tool complex is relatively simple, but marked by a high frequency of milling equipment. The presence of milling equipment has been interpreted as indicative of plant exploitation, but no direct subsistence has been obtained to support this assertion. Future studies should make a concerted effort to link material culture to specific data related to subsistence, such as macro- or microbotanical remains.

4. How does the character of the milling equipment recovered from sites located in the rocky coast landscapes distinct from the sandy and lagoonal coast assemblages?

The role of milling equipment in coastal contexts is highly debated and there is a lack of direct evidence regarding what they were used to process. Much of what is known about the milling equipment in coastal settings is from the sandy and lagoonal landscape. It is important to have comparative assemblages from the rocky coast landscape so that the similarity and/or distinctiveness in the use of the as-

5. What was the role of marine fish in the prehistoric diet of the Archaic period populations, and how did it change in the Late Prehistoric period?

Research on Camp Pendleton has begun to reveal an interesting change in fishing strategies over time (Wake 1999). Early Archaic contexts have generally yielded the greatest diversity and densities of fish, including those characteristic of near-shore open coasts, rocky bottom, and bay/estuarine environments. Late Archaic sites have larger sized fish, such as tuna and mackerel, in higher densities. The subsequent Late Prehistoric period witnessed a dramatic decrease in fish densities, and fish were represented mostly by open coast and sandy beach species. Further research should examine whether these trends are local or represent a wider set of changes tied to paleoenvironmental factors or social factors.

6. What are the trends in the exploitation of marine fish over time? Are the trends similar or distinct in the sandy and lagoonal coast and rocky coast landscapes?

Intriguing temporal trends in the exploitation of marine fish have been observed for the Camp Pendleton sandy and lagoonal landscape (Wake 1999). Are similar trends present in the rocky coast landscape? Is there a trend toward a focus on large fish over time? Were fish replaced by shellfish at any point in prehistory?

7. What is the nature of the interaction between paleoenvironment stresses and resource intensification during the late Holocene?

One of the most important unresolved issues for the sandy and lagoonal landscape is the interrelationship between paleoenvironment stresses and resource intensification during the late Holocene as asserted by Byrd and Reddy (1999, 2002) and debated by Rosenthal et al. (2001). Potentially high population densities, intensified economies, complex sociopolitical systems, and the dependence on labor intensive, but storable, resources may have put late Holocene hunter-gatherers in an ecological high risk situation. Research should examine the issue of resource intensification of marine and terrestrial resources in the context of late Holocene environmental fluctuation. The role of small meat packages, such as the *Donax gouldii* shellfish, in the prehistoric diet should be examined by comparing caloric and protein model applications.

8. What is the long term trajectory of overexploitation of high ranked food resources in the coastal and the mainland inland landscapes?

Broughton and O'Connell 1999, Raab and Yatsko (1998), and others have argued that over time, prehistoric populations in coastal southern California overexploited high ranked resources, which resulted in depletion and subsequently required resource intensification through a shift to costly resources. Future research should be structured to address this issue in the coastal and inland landscapes through comparisons of caloric and protein models of animal and plant resource use at a range of sites over time.

4.6 Theme: Technological Innovations

Elucidation of the precise character of the technology used by a culture provides fundamental information about its ecological adaptations; similarly, technological change over time provides integral information for chronology building, the pace of culture change, and adaptability of a culture. Compared to other regions, both in North America and worldwide, the technological change, as expressed in preserved material culture, among coastal California hunter gatherer cultures is moderately slow. It also varied significantly based on geographical location along the coast (north, central or south) or islands.

Technological innovations reflect human interaction with the environment, ingenuity, and the sharing of knowledge—in some instances as a result of contact with different cultural groups. Numerous technological innovations have been highlighted during California prehistory. The development of the mortar and pestle (5000–3500 B.P) enabled native Californians to expand their resource base to include acorns. Arnold (1995, 2001) theorizes that the refinement of the plank canoe around A.D. 800–1000 may, in part, have been an important factor in the rise of social complexity that began soon afterward.

Some of the research issues worth further study include technological changes and innovations related to fish hooks, fish nets, dugout canoes, and ceramic production, adoption of the bow and arrow: and the proliferation of bedrock milling in inland areas. The pace and timing of these technological changes should be modeled for the region, and hypotheses should be offered to explain their appearance. It is also useful to compare the timing of their adoption on the mainland coast and the southern Channel Islands. For example, fish hooks were a very important technological innovation on the islands, but of minimal importance on Camp Pendleton's mainland coast. Similarly, technological details related to changes in the morphology of bedrock milling have been tied closely to specific types of plant resource exploitation by True (1966), but macrobotanical studies have not supported the correlation between feature form and function (Reddy 1999).

Research issues related to technological innovations are distinct for the islands and the mainland; therefore, they will be discussed separately. Research questions for the three mainland landscapes (sandy and lagoonal coast, rocky coast, and inland highlands) are collapsed into a single category because there are shared by all three landscapes.

4.6.1 Islands

Understanding the types of technologies used on San Clemente and San Nicolas Islands, and the timing of these innovations will help characterize the Islanders' relationship with their environment as well as with neighboring groups on the mainland.

1. Can certain tool kits be associated with particular procurement strategies and time periods?

Strudwick (1995b) suggests pitted stones may have been used to process *Tegula* sp. Strudwick (1985) has also identified a tool kit that was likely used to manufacture shell fishhooks. Can specific technologies reflect particular islands' traditions?

Addressing this research issue will require examining tools, debris from manufacturing, midden constituents, and other cultural materials to identify tools and tool kits. Emphasis should be placed on how these tools and tool kits might have changed over time and how these changes were linked to environmental fluctuations and sociocultural adaptations in the neighboring region. Tools and tool kits from the two islands should be compared to determine whether significant similarities or differences exist between the assemblages, perhaps reflecting unique traditions or traditions that are shared by other cultural groups.

2. What is the timing of shell fishhook production and use on the islands?

Strudwick (1985) notes that initial use of the shell fishhook began in southern California approximately 3,500 years ago, if not earlier. One of the earliest shell fishhooks found on San Nicolas Island was recovered from CA-SNI-161 in a context dating to approximately 3,000 years ago (Vellanoweth and Erlandson 1999). In contrast, CA-SNI-16, occupied beginning around 2290 B.C., has not yielded shell fishhooks in subsurface deposits. On San Clemente Island, circular shell fishhooks appeared around 3,300 RYBP at Eel Point (CA-SCLI-43) (Raab, Bradford, Porcasi, and Yatsko 1995), perhaps the earliest known date for such hooks in coastal California. Future research should aim to validate this finding by examining and dating similar hooks from other sites. This should provide stronger evidence of when they were used widely on the islands. Strong dating evidence will also provide insights into whether the use of shell fishhooks leads to dramatic changes in population density and, perhaps, social complexity.

Such research efforts will require extensive chronometric data. Shell fishhooks should be dated either directly or by association (if the hook is recovered from a reliable context). Reliable dating is key to determining both when fishhooks were first used and when this technology appears to have been widely used on the island. Examination of population density, settlement and subsistence patterns, other technological innovations, and social organization during this time period may provide insight into how the development of the shell fishhook affected the lives of early San Nicolas islanders.

3. Did changes in flaked stone and ground stone technology take place on the island?

The flaked stone technology on San Clemente Island has not been systematically analyzed (Raab and Yatsko 1998). Similarly, ground stone assemblages from middle Holocene sites on San Clemente Island are known, but have not been studied in detail using modern scientific methods. An important research emphasis in future studies should be the study of these artifacts for technological, stylistic and

functional elements. This should include raw material reliance patterns, including the use of imported raw material.

Clevenger (1982) identified what she termed a split cobble core-reduction strategy on San Nicolas Island. She describes this strategy as a type of bipolar reduction technique that involved placing a metavolcanic or metasedimentary cobble on an anvil and striking it to remove initial flakes. Additional flakes were later removed by direct freehand unidirectional percussion. Rosenthal and Padon (1995) identified a second core reduction technique that involved systematic, multidirectional core reduction; unresolved questions whether the two techniques were used during the same time periods; and whether one was preferred or had an advantage over the other.

Addressing this research issue will require examining sites containing lithic reduction assemblages and identifying the types of core-reduction strategies that were used at the sites. Research should focus on lithic material types, date of site occupation, proximity to lithic procurement sources, and types of production and processing activities that occurred at the site. Key differences between the sites may reveal why one core reduction strategy was selected over the other and whether these techniques were functionally linked to particular tool types or tool kits.

4. What was the role and function of modified sea urchin spines?

Sea urchin spines that appear to have been modified were identified at CA-SNI-39 and were spatially associated with *Olivella* shell bead making debris. Maxwell et al. (2007) proposed that in the absence of a chert microlith industry on San Nicolas Island, sea urchin spines may have been used to drill *Olivella* beads. Were sea urchin spines used to drill *Olivella* beads? If so, what are the implications for bead production and trade in southern California?

Replication studies and use wear analyses should be carried out to determine whether sea urchin spines could have been used to drill *Olivella* shells. Additionally, investigations should focus on whether postdepositional processes or other noncultural processes can potentially alter sea urchin spines to give them a drill-like appearance. Diameters of potential sea urchin spine drills should be compared to perforation diameters of *Olivella* beads to determine whether they are similar in size. Additionally, a review of ethnographic information may reveal that sea urchins were in fact used as drills elsewhere or may perhaps identify other types of materials that were used as drills. Sea urchin spines from other sites containing *Olivella* bead-making debris should be examined as they may also show evidence of use as drills.

5. When was the bow and arrow introduced?

Late Holocene sites on San Clemente Island have yielded increased quantities of small projectile points, which led scholars to hypothesize adoption of the bow and arrow as a hunting weapon to exploit sea otters (Porcasi 1995; Porcasi et al. 2000). This pattern should be explored further through rigorous examination of artifact distribution and correlation with faunal data. Furthermore, comparison

to San Nicolas Island late Holocene data is necessary in understanding whether the bow and arrow technology may have been a regional behavior response to late Holocene environmental stress and resource intensification.

6. Were canoes constructed on the two islands?

Considering that the refinement of the plank canoe occurred around A.D. 800–1000, research efforts should focus on sites that date to this period. Sites should be examined for evidence of wood and tool kits likely associated with the manufacture of canoes (such as those identified by Cassidy et al. [2004] for the early Holocene on San Clemente Island). Additionally, a review of ethnographic literature may reveal references to the manufacture of canoes on the islands or, alternatively, from which groups islanders may have obtained canoes.

4.6.2 Mainland (Sandy and Lagoonal Coast, Rocky Coast, and Inland Highlands)

In considering research directions related to technological change on the mainland, the coast and inland areas will be discussed together. Seven research issues have been identified for these landscapes.

1. When was bow and arrow technology adopted by the inhabitants of the coastal landscapes? Did it vary considerably from the timing of adoption in the inland highlands?

Scholars contend that the bow and arrow technology was adopted into the corpus of southern California coast material culture in the Late Prehistoric period in the uplands (Meighan 1954; True 1966; True and Waugh 1982; Warren 1964, 1968). However, given the dearth of projectile points on coastal sites, the pace and timing of their adoption in the coastal landscape remains unresolved.

2. Is there any evidence for dugout canoe construction along the coast in the late Holocene (Late Archaic and Late Prehistoric periods)?

Archeological sites within the coastal landscape of Camp Pendleton have yielded evidence that suggests that late Archaic populations caught offshore fish such as tuna and mackerel (Wake 1999). Tuna are epipelagic and swim near the shore seasonally, and mackerel are a pelagic fish. Therefore, their exploitation may have been facilitated by the use of the canoe. In the Late Prehistoric period, open coast types dominate the archeological fish remains. Given this scenario, research efforts should focus on trying to identify tool kits associated with canoe manufacture such as those defined by Cassidy et al. (2004) for the early Holocene on San Clemente Island.

3. Why are fishhooks rarely encountered on the mainland?

Related to the question of presence and manufacture of canoes is the use of fishhooks by prehistoric populations in the coastal landscapes of southern California. Fishhooks were of immense importance on the islands, but of minimal importance at Camp Pendleton. Despite the recovery of fish remains from Archaic and Late Prehistoric sites on Camp Pendleton, shell fishhooks are uncommon in these sites

(see Byrd 1996a; Byrd and Reddy 2002). The lack of fishhooks (in association with the types of fish exploited) suggests that fishing was predominately focused on use of nets to capture schooling fish in surf. Future research in southern California coastal landscapes should be designed to delineate whether this practice identified on the sandy and lagoonal landscape of Camp Pendleton is a local or wider pattern.

4. Can the relationship between bedrock milling features and resources utilized be defined?

True (1966) asserted that the morphology of bedrock milling in the mainland inland highlands landscape has been tied closely to specific types of plant resource exploitation. Macrobotanical studies designed to test this hypothesis have not supported the correlation between feature form and function (Reddy 1999). Due to a general lack of rigorous, problem oriented paleoethnobotanical studies in this general region, scholars have indiscriminately associated bedrock milling feature morphology with particular plant resource utilization. Southern California prehistoric research would greatly benefit if research projects integrated macrobotanical studies, residue analysis, and experimental research into their analysis in the projects. This would allow interpretations of plant subsistence practices to be based on direct evidence and not on unsubstantiated supposition.

5. Do core-to-biface ratios reflect mobility patterns?

Lithic core-to-biface ratios have been used as a means to examine prehistoric mobility (see, for example, Bamforth and Becker 2000). Core-to-biface ratios may be suitable to tackle the issue of longevity of coastal sites and mobility of the prehistoric populations.

Using core-to-biface ratios, Becker and Iverson (2004), have argued that a stable adaptive strategy of flaked stone tool use is evident through the Holocene in San Diego County. In addition, they assert that core-to-biface ratios at sites in the coastal landscapes suggest more sedentary lifestyles as compared to the ratios at sites in interior valleys (not the inland highlands), which indicate more mobile and relatively briefer occupation. These results support prior models by Byrd (1998), Byrd and Reddy (2002) and Reddy (1999) regarding coastal occupations. Research should continue pursuing this line of analysis to determine whether this is a localized pattern or systematic of a wider pattern.

6. What is the timing of ceramic use and production in the mainland inland highland landscape?

As with bow and arrow technology, scholars contend that ceramics were adopted during the Late Prehistoric period in the uplands (Meighan 1954; True 1966; True and Waugh 1982; Warren 1964, 1968). The adoption is assumed to be from groups to the east (Colorado River and Desert groups). Hildebrand (2003) concluded that “ceramic usage on the lower Colorado River was ongoing by perhaps A.D. 500.” Scholars generally agree that adoption of ceramics into the San Diego County area was around A.D. 950. What remains unresolved is the direction of the adoption: was it east to west and/or south to north? Although there seems to be

4.7 Theme: Socioideological Aspects of Culture Change and Interaction

Social and ideological aspects of cultural adaptations are not easily deciphered in the archeological record; nonetheless, archeologists have regularly attempted to address them. In this research design, four particular issues are emphasized: the timing of the Shoshonean Wedge versus repeated movement between the desert and the coast; coastal/inland trade network systems; shell-bead exchange, especially the middle Holocene southern Channel Islands interaction sphere (Howard and Raab 1993); and mortuary behavior.

What is referred to as the Shoshonean Wedge is a body of linguistically similar people in the central part of southern California. The Shoshonean speakers are also referred to as the Takic speakers (a subset of the Uto-Aztecan). It is thought that there was a migration of Shoshonean-speaking people from the east to southern California perhaps as early as 2,000 years ago. Ethnohistorically and ethnographically, the Luiseño and the Juaneño are Shoshonean populations living in northern San Diego, southern Orange and southeastern Riverside Counties who are linguistically related to the Gabrielino to the north and the Cahuilla to the east (Kroeber 1976). Shoshonean cultural characteristics include the use of small triangular projectile points, mortars and pestles, steatite ornaments and containers, perforated stones, circular shell fishhooks, and numerous and varied bone tools, as well as bone and shell ornamentation (Meighan 1954). In addition, elaborate mortuary customs, along with the generous use of asphaltum and the development of extensive trade networks, also characterize this linguistic group.

Research issues related to social systems, ideology and culture change are distinct for the islands and the mainland; therefore, they will be discussed separately. Research questions for the three mainland landscapes (sandy and lagoonal coast, rocky coast, and inland highlands) are collapsed into a single category because they are shared by all three landscapes.

4.7.1 Islands

Despite their relative isolation from the neighboring Channel Islands and mainland, the prehistoric populations of San Clemente and San Nicolas Islands played an integral role in regional and long distance interaction spheres. The distribution of OGR beads has linked these islanders to parts of the California coastal mainland, and the northern and western Great Basin beginning around 5000 B.P. (Howard and Raab 1993; Vellanoweth 2001). Compared to other regions and San Clemente Island, San Nicolas Island has produced the largest number of OGR

beads ($n = 146$), including ones from different stages of manufacture (Vellanoweth 2001).

Interestingly, OGR beads appear to be absent from the northern Channel Islands and most of the Santa Barbara region. Researchers theorize this distribution reflects an interaction sphere between Takic speakers (Howard and Raab 1993; Vellanoweth 2001). This pattern has broader linguistic implications. To explain an unusual linguistic distribution in southern California, Kroeber (1976) suggested that Shoshonean groups occupying the eastern desert region split off from parent bands and migrated to the coast. These Takic speakers settled along the coast and southern Channel Islands, replacing indigenous Hokan speakers and thus driving a linguistic wedge between the north and south coast. Kroeber (1976) suggested a Shoshonean incursion occurred around 1,500 years ago.

The timing of this incursion as well as whether there were one or many movements from the desert to the coast, is much debated. The distribution of OGR beads provides evidence for a potentially early incursion of Takic speakers, around 5,000 years ago (Howard and Raab 1993; Vellanoweth 2001). The presence of Shoshonean traditions along the coast, including cremations, obsidian projectile points, S-twining weaving techniques, sweathouses, and dog burials, provides evidence for a possible arrival between 2000 and 500 B.C. (Kowta 1965; Lauter 1982; Rozaire 1959). Linguistic evidence and human osteological studies provide evidence for a possible late incursion around A.D. 500 (Titus 1987; Walker 1986).

Titus and Walker (2000) have noted morphological differences between crania from two sites (Eel Point, CA-SCLI-43, and the Nursery site, CA-SCLI-1215) on San Clemente Island indicating that two genetically different populations were living on the island at different points in time. Furthermore, the scholars also identified significant dietary differences between these populations based on dental caries. The middle Holocene Eel Point (CA-SCLI-43) inhabitants had a protein rich diet (perhaps fish rich) whereas the late Holocene Nursery site (CA-SCLI-1215) population (1500 B.P.) had a carbohydrate heavy diet.

Kerr and Hawley (2000) examined 89 human crania recovered from Early and Late Period contexts on San Nicolas Island. Non-metric cranial data suggest there is a dichotomy between selected traits for Early and Late Period populations. Metric data indicates there is cranial variability between Early and Late Period groups as well. Nevertheless, Kerr and Hawley (2000) suggest that there is no statistical correlation between nonmetric and metric data that would indicate there was a population replacement or change on San Nicolas Island. Rootenberg's (1960) analysis of skeletal remains from San Nicolas Island shows temporal differences in cranial morphologies similar to those observed by Titus and Walker (2000) on San Clemente Island. These results are consistent with the hypothesis that the two islands had indigenous populations and there was a later intrusion of the long headed Uto Aztecan speaking (Shoshonean) populations.

Although the timing of arrival of Takic speakers on San Nicolas Island remains to be fully clarified, there is substantial evidence indicating that islanders had ties with the Great Basin region and elsewhere. Obsidian found in archeological deposits on the two islands was obtained from sources located in the western Great Basin, approximately 360 km from the island (Rick et al. 2001). Evidence of exotic materials on the islands also reveals more localized interaction spheres as well. The presence of steatite, serpentine, and Monterey, Franciscan, and Cico chert links the islanders to groups on the other Channel Islands and the mainland. In exchange for these imported materials, the islanders may have traded marine food resources, *Olivella* beads and other shell ornaments, stone effigies, high quality sandstone bowls and pestles, pigments, and other locally available or manufactured goods.

Because of the dearth of ethnographic information pertaining to the native people of San Clemente and San Nicolas Islands, there are large gaps in our understanding of the islanders' social structure, ideologies, and ties with other cultural groups. Research avenues that will address many of these information gaps as well as the connections of San Clemente and San Nicolas Islands to the region include the timing and nature of the Shoshonean incursion, mortuary behavior, coastal/inland trade network systems, and shell-bead exchange. Some of the questions of particular importance follow.

1. When did Takic speakers first arrive on the two islands? Does the incursion represent a single migration or repeated movements between the island and interior mainland?

Efforts have been made to determine when Takic speakers first arrived on the two Islands; however, the timing and pace of the Shoshonean incursion remains unclear. Addressing this research issue will require extensive chronometric data as well as the identification of Shoshonean traditions (versus Hokan characteristics) and determining when they first appear in the archeological record. Additional human osteological studies may reveal distinct differences between early and late populations, perhaps reflecting the arrival of Takic speakers. Comparisons of osteological data from the islands and mainland may reveal significant similarities and differences between populations, perhaps elucidating the timing and movement of desert and coastal migrations.

2. What types of mortuary practices were used on San Clemente Island and San Nicolas Island? What do mortuary practices tell us about the Islanders' cultural affiliations, social structure, and ideologies?

The prehistoric populations of San Clemente Island practiced primary inhumations initially and then secondary inhumation of cremated remains, although the sample size is too small for statistical significance. Titus and Walker (2000) argue that the Islanders generally buried their dead rather than cremating them, despite their cultural affiliation to the Gabrielino, who cremate their dead. The primary reason for this preference was the lack of firewood on the island, a necessary requirement for cremation and associated rituals.

Understanding mortuary practices on the island will require examining burial features including human remains and associated burial goods. Research efforts should focus on change and continuity of burial practices over time and how these changes might be related to population replacements. Examining associated grave goods may reveal information regarding cultural identity, status, lineage affiliation, gender roles, domestic and ritual activities, and belief systems. Comparisons of burials on the islands with those on the mainland may help to characterize cultural affiliations.

3. What trade networks did the San Clemente and San Nicolas Islanders participate in, and when were these networks established? What types of items were imported to and exported from the islands? Is there evidence of trends of increased or decreased trading?

Tracing past trade networks will require identifying exotic materials in the archaeological record and determining their sources of origin. In some cases, ethnographic accounts may provide information regarding where exotic materials were obtained and what groups may have traded these items. Chemical sourcing of materials may be necessary as well. Comparisons of types and frequencies of exotic materials from sites on the islands may reveal increased or decreased levels of trading activities. Additionally, research efforts should focus on the types of items the islanders may have produced in exchange for exotic goods. Comparisons of finished artifacts with associated manufacturing debris may reveal a disparity between the quantities of items produced and retained at site (e.g., quantity of *Olivella* bead detritus versus finished beads). Such a disparity may reflect removal of items from the island, possibly as a result of trade.

4. What was the nature of shell-bead exchange in the prehistoric coastal inland trade system?

Understanding shell bead exchange is one crucial aspect of defining and delineating prehistoric coastal-inland trade networks. The distribution of OGR beads provides evidence for an interaction sphere connecting the southern Channel Islands, adjacent coastal mainland, and the northern and western Great Basin as early as 5000 B.P. OGR beads found in different stages of manufacture on San Nicolas Island indicate that they were produced locally. What remains elusive is the initial timing of this shell-bead production and its longevity. Are there other types of artifacts that share a similar regional distribution with OGR beads? Did the islanders produce shell beads for local use as well as trade?

Addressing this research issue will require identifying the earliest evidence of shell beads on the islands. Efforts should focus on identifying beads from sites occupied during the early Holocene and the beginning of the middle Holocene. Comparisons of early bead styles and other artifact assemblages recovered from island and mainland comprising the southern Channel Islands, adjacent contexts may provide additional evidence to support coastal mainland, and northern and western Great Basin interaction sphere. Sourcing of *Olivella* shells may help to trace prehistoric and historical period shell bead exchange networks as well. Carbon isotope studies have proven to be effective in identifying *Olivella* sources based on general geographic locations (i.e., northern California and southern Ore-

gon, Santa Barbara mainland and Santa Rosa Island, and Santa Cruz Island) (Eerkens et al. 2005). Continued research has the potential to refine spatial resolution, perhaps to an island specific level. Additionally, a review of ethnographic literature may provide specific information regarding which groups participated in shell bead production and exchange. Finally, comparisons of artifact assemblages may reveal strong cultural ties between groups, perhaps, in part, as a result of extensive trade interactions.

5. Can the term “interaction sphere” be used for the middle and late Holocene cultural interaction observed between the islanders and mainlanders in the study area?

Altschul and Grenda (2002) have argued for an “interaction sphere” between the islanders and the mainlanders, but do not define the precise nature or extent of the interaction. It is important that the nature of the interaction (i.e., direct or indirect) be identified, and that questions regarding whether it changed over time, and if it was dependent on the groups in question be answered. Also, the main premise of the cultural interaction models offered to date is economy. Future research should aim to identify data that can aid in the identification of other social elements such as intermarriage and religion in the cultural interaction.

6. Was there a primary direction in the cultural interaction (i.e., was it more critical for the islanders)?

Altschul and Grenda (2002) argue that, with the exception of populations on the primary islands (Santa Cruz, Santa Rosa, and Catalina), islanders could not have lived in isolation, primarily because of a lack of fresh water sources and diverse resources. Given the dense early and middle Holocene occupations on San Nicolas and San Clemente Islands, this model needs to be evaluated more extensively. In doing so, the impetus for establishing an economic network (or interaction sphere) should be evaluated in this light. In other words, if living in isolation was not environmentally (or culturally) viable, was trade and interaction an evolutionarily adaptive behavior for the San Nicolas and San Clemente Islanders?

4.7.2 Mainland (Sandy and Lagoonal Coast, Rocky Coast, and Inland Highlands)

In contrast to the two islands, the coastal mainland landscapes considered in this project are not in geographic isolation from culture contact. The presence of various exotic raw materials at many sites in all the mainland landscapes suggests that local and regional communication/trade networks were in play throughout the Holocene. Culture contact, especially through the coastal/inland trade network systems, has been discussed in the literature and documented for the region (Korper and Fife 1985; Johnston 1980). The most common materials used for these studies are lithic raw materials. Given the diverse range of landscapes within the study area, research should examine the obvious dichotomy between the coast and inland areas, but also the potential for much smaller exchange networks. For example, the recovery of shellfish and fish remains from inland sites on Camp Pendleton prompted Reddy (1997) to suggest localized trade and exchange between the coast and inland populations.

1. Did the obsidian source change over time? Was this due in part to function, location, and technology at the different sites?

Obsidian artifacts have been recovered from some sites within the coastal and mainland inland landscapes. Although they do not appear in high frequencies and are often fragments, their presence suggests contact with nonlocal groups. In addition, obsidian artifacts appear in relatively higher frequencies in Late Prehistoric as compared to Archaic, contexts. The obsidian sources include the Butte source in Imperial County, the Coso volcanic field in the southwestern Great Basin, and possibly, the northeastern Baja San Felipe obsidian source (Figure 13).

There is considerable disagreement on which sources were utilized in different time periods. According to Hughes and True (1985) Obsidian Butte was the primary source during the Late Prehistoric period. However, Ericson (1977, 1981) proposed that there is a fairly uniform decline in the proportion of obsidian with increasing distance from the Obsidian Butte source. A more complex pattern of use was observed by Shackley (1981) who suggested that distance to source was crucial in determining frequencies. Several questions need to be resolved in this context. Can the varying frequencies be related to trade/exchange routes, access to other raw materials, and technology (i.e., bow and arrow)?

2. Was steatite acquired through extraregional trade?

Steatite artifacts have been recovered from several sites in the coastal and inland mainland landscapes; however, the source of the steatite has not been empirically demonstrated. There are two well known sources for steatite extraction and production: Catalina Island and Pelona in Los Angeles County (Heizer and Treganza 1972;

Kroeber 1925; Rosenthal and Williams 1992) (see Figure 13). There are, however, smaller local sources of steatite within San Diego County: Stonewall Peak (CA-SDI-9039, CA-SDI-9040) in Cuyamaca Rancho State Park, Jacumba Valley (CA-SDI-7790), and Boiling Springs (CA-SDI-8538) on Mount Laguna (Graham 1981; Heizer and Treganza 1944; Parkman 1983, 1985; Polk 1972; Treganza 1942). Although there have been no known attempts to source steatite from archaeological sites, Rosenthal and Williams (1992) demonstrated the potential to microscopically distinguish different steatite sources. Therefore, it is important that microscopic and chemical analysis be conducted on steatite items on the mainland to ascertain the source of the raw material and establish trade/exchange networks using empirical data.

3. What are the implications of the recovery of marine resources from inland sites?

Marine shell was recovered in several sites in the mainland inland highland landscape located at least 10 km from the coast (for example Reddy 1997a). Reddy (1997) has suggested that either foraging parties brought back these resources (*Donax gouldii*) during their extended seasonal trips to the coast, or the inland groups could have obtained them through exchange with the coastal groups.

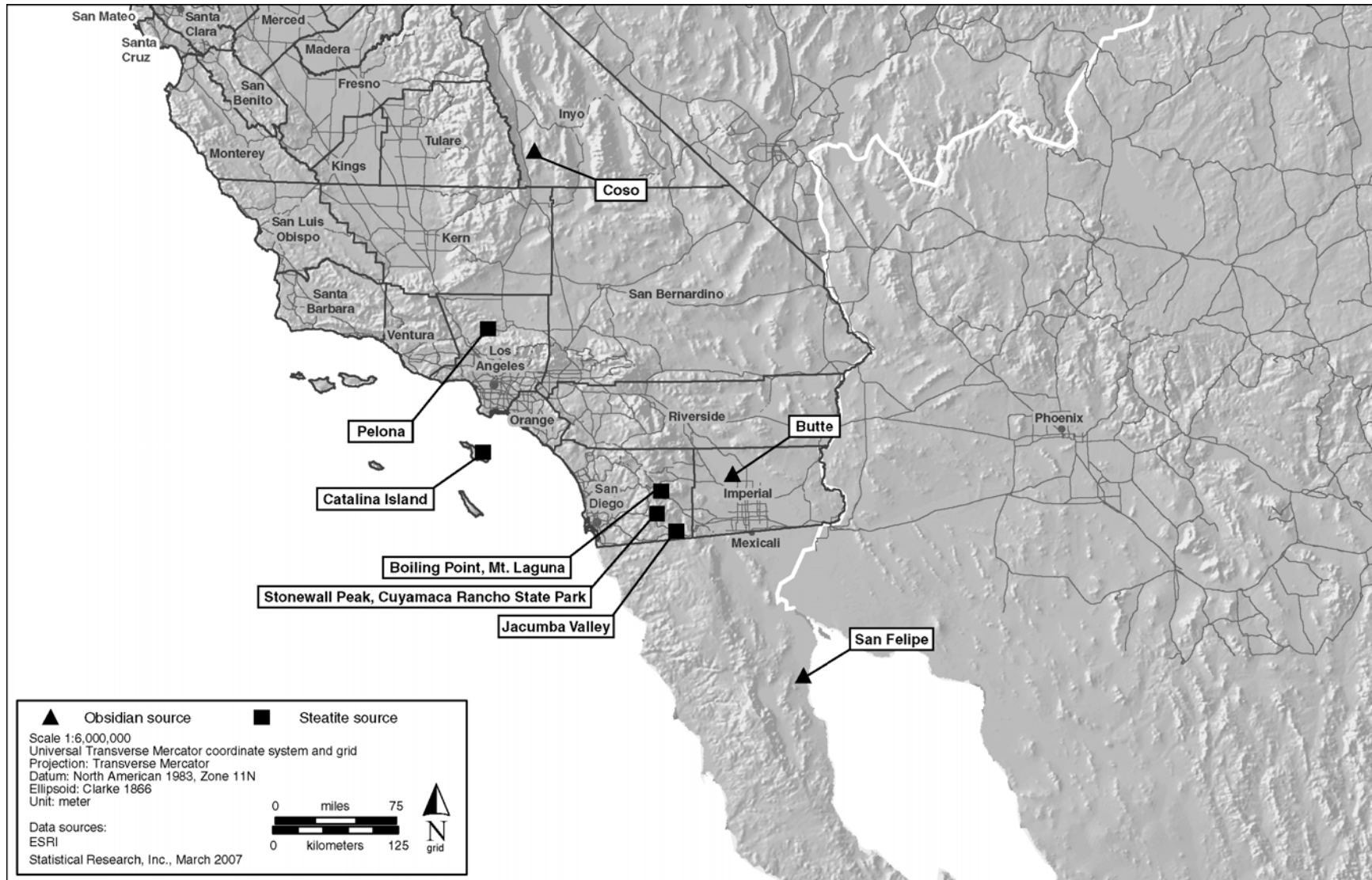


Figure 13. Location of steatite and obsidian sources mentioned.

Systematic future analysis should be able to address questions related to local trade/exchange networks. For example, are shellfish that were used for shell beads or ornaments represented at inland sites? Could the calcium carbonate in the shells be a preferred chemical for leaching acorns? Are there any shellfish that could have functioned primarily as food and then were been secondarily as ornaments?

4. What is the timing of the arrival of Takic speakers to the region? Did they come from the east or from the north?

The arrival of the Uto-Aztecan speakers, also termed the Shoshonean Wedge, has long been accepted as an important cultural development for the region. In the San Diego County area, this event is associated with the onset of the Late Prehistoric period (at approximately 1500 B.P.). This is, however, an unresolved issue, because no archeological evidence has been presented to signal the arrival of these desert populations on the coast. The timing and pace of the arrival of the Shoshonean populations needs to be modeled using appropriate cultural evidence. Alternatively, the potential for repeated movements between the desert and the coast should be considered as another explanation (Altschul et al. 2005). Research methods need to be developed to identify these two variations of prehistoric population movements.

5. When was cremation introduced to the region?

There is a general consensus that disposal of the dead was a cultural trait that separated Archaic populations from the Late Prehistoric cultures in San Diego County. Cremations have also been identified as one of the key indicators of the Shoshonean Wedge. Cremations, however, are not uniformly encountered in the mainland study area. For example, with the exception of a recent discovery of a single cremation in the Ysidora Flats area (Andrew York personal communication 2007), cremations are absent on Camp Pendleton in northern San Diego County (Byrd and Berryman 2006). However, there is significantly more evidence of cremations from, coastal southern part of the county.

The Yumans, thought to have arrived in the region around 2000 B.P, brought the practice of cremation with them to the southern part of San Diego County. Van Camp (1979) proposed a chronological succession of funerary practices from un-gathered cremations to pit-gathered cremations to urn-gathered cremations. Similarly, True (1966, 1970) defined the Cuyamaca complex as the use of cemetery areas separate from living areas, the use of grave markers, the placement of cremations in ceramic urns, and the “use of specially made mortuary offerings such as miniature vessels, miniature shaft straighteners, elaborate projectile points, etc.”

Future archeological investigations should aim to refine the timing and spatial distributions of various burial practices (burials, cremations, and funerary urns [secondary]). Continuity and change of mortuary behavior is an important research avenue that needs to be examined.

6. Can Chingichngish religious practices be identified in the Late Prehistoric mainland archeological record?

Chingichngish is the name of an important figure in the mythology of the Luiseño Indians of southern California and was first mentioned in a description of the beliefs of the native peoples who were associated with the mission of San Juan Capistrano. Some scholars have characterized Luiseño religion in general, or certain portions of it, or a set of some of its more widely shared traits, as a Chingichngish cult (Dubois 1908; Kroeber 1925). Beliefs associated with Chingichngish reached the Luiseño from the Gabrielino. Kroeber (1925) suggested that Chingichngish beliefs were a historical period native response to the cultural shock of the missions, and White (1963) thought that they might have arisen in response to earlier contacts with European sailors along the California coast. Some important material correlates of the Chingichngish beliefs include ceremonial sacred items such as mortars and winnowing trays (White 1963). When not used as functional items, mortars and winnowing trays are also considered to be associated with the Chingichngish practice, but the precise nature of their role is not understood. An important Chingichngish practice was the ingestion of the hallucinogenic plant *Datura* (toloache, or jimsonweed). However, ingestion of this plant cannot be associated only with Chingichngish. Future research should define artifact classes and methods that can be used to identify whatever Chingichngish practices were carried out on Camp Pendleton in the past.

7. Can the Chingichngish religious practices observed at Big Dog Cave (CA-SCLI-119) on San Clemente Island be correlated to mainland practices?

Big Dog Cave (CA-SCLI-119), located on the southern coast of San Clemente Island, California, has yielded ceremonial and subsistence components and includes artifacts indicative of both prehistoric and historic period Gabrielino occupations (Raab and Yatsko 1998). Scholars have referred to the ceremonialism as being related to the Chingichngish religion. This suggests strong cultural contact between the mainland and the island. Were the religious practices adopted through contact, or was there population movement? Are the Chingichngish practices on San Clemente Island largely similar to those observed on the mainland?

5 Approach

This chapter presents the project design that will aid in identifying, evaluating, and developing approaches to a variety of archeological sites within the four landscape categories in the study area. Such an approach decreases the number of individual, case-by-case undertakings and facilitates a more effective management process for precontact (prior to A.D. 1769) cultural resources.

Specific project designs are presented for San Clemente Island, San Nicolas Island, Camp Pendleton (sandy and lagoonal mainland coast and mainland inland highland landscapes), and NB Point Loma (rocky mainland coast landscape). The archeological record of each landscape category, including the range of site types, categorization of the sites into different classes for research and management and pragmatic approaches to management of these classes of sites, is discussed. It should be noted that the prehistoric archeological sites are the primary cultural resources considered in the study. Traditional cultural properties without prehistoric archeological correlates are not addressed.

5.1 San Clemente Island Archeological Record

Archeological investigations on San Clemente Island can be traced back to the late nineteenth century when Paul Schumacher, a land surveyor, visited the island and collected museum quality artifacts (Raab and Yatsko 1998). His records are meager and do not provide any information on collection locations. Raab and Yatsko (1998) suspect that most of his finds were from the north end of the island, perhaps from the Sand Dunes. Several other collectors and looters came to the island, until as recently as the early 1930s. When the island became a U.S. Navy reservation in 1934, all illicit collecting ended, and archeological sites became protected resources over time.

Some of the early investigations on the island were done by the Los Angeles County Museum of Natural History under the direction of Arthur Woodward between 1939 and 1941 (Raab and Yatsko 1998). In the 1950s, archeological studies on the island, primarily conducted by the University of California, Los Angeles (UCLA), had a culture history and ecology focus (Meighan and Eberhart 1953). Problem oriented archeological research on San Clemente Island first started during this period; for example, McKusick and Warren (1959) documented the rich deposits at Eel Point (CA-SCLI-43) and offered a cultural chronology for the island (Milling Stone complex, Mortar and Pestle complex, and Big Dog complex). Archeological research on the island changed considerably after 1970 with the change in state and Federal laws concerning protection of cultural resources (Raab and Yatsko 1998). This resulted in several systematic surveys of the island, such as those done by Axford (1984), who recorded 1,634 sites and collected about 20 radiocarbon dates from a range of sites (Breschini 1996: 50–51). Raab and Yatsko (1998) assert that the most dramatic research development has been conducted since 1983, when the Cultural Resources Management Program on the

island took on a much more definitive direction and oversight. Noteworthy studies include those done through the UCLA field schools, California State University, Northridge field schools, and CRM projects. Another important development in the past two decades is the decidedly innovative and rigorous long term study of human occupation at Eel Point (CA-SCLI-43), which has contributed immensely to our understanding of trans-Holocene island adaptations.

Archeological sites are found in all the topographic zones on San Clemente Island; the sites are discrete, with well defined surface indicators and midden boundaries. Small shell midden sites predominate; they have a wide variability in densities of marine shell and occur in level to moderately sloped terrains or in rockshelters. There are at least 3,400 documented archeological sites, representing adequate survey coverage of about 50 percent of the island surface area (Andrew Yatsko, personal communication 2007). The Coastal Terraces (which comprise 8 percent of the island surface) have a very high site density, with 200–400 sites per km² (Raab and Yatsko 1990; Yatsko 2000), and include large, complex, multicomponent sites such as Eel Point (CA-SCLI-43), cave sites (Xantusia Cave), small shell bearing middens (some of which have house floor depressions) (Raab 1992), and small shell scatters. The Upland Marine Terraces (accounting for 34 percent of the island surface) have a moderately high density of sites with 25–100 sites per km² (Raab and Yatsko 1990; Yatsko 2000). These typically include shell bearing middens (including the *Tegula* middens), lithic scatters, lithic production loci, and remnants of prehistoric houses/structures.

The Sand Dunes (which account for 3 percent of the island's surface) have deeply buried cultural deposits; the site density is not known, given the high potential for buried sites (Raab and Yatsko 1990; Yatsko 2000). Note that this area was the primary focus of the illicit collection before the island became a Navy installation. The Plateau (which is about 40 percent of the island surface) has 8–105 sites per km² and some large surveys have documented contiguous areas of the higher Plateau (perhaps larger than a km²) that are completely devoid of sites (Andrew Yatsko, personal communication 2007). The sites on the Plateau are typically small, deflated, shell bearing midden deposits and low density lithic scatters, with some expansive/complex sites (e.g., the Nursery [CA-SCLI-1215] and Ledge [CA-SCLI-126] sites). The Eastern Escarpment (which is about 11 percent of island surface) is a large, archeologically undocumented area. If present, sites would most likely be associated with either the benched or terraced areas of this rugged terrain or with rockshelters (Andrew Yatsko, personal communication 2007). The last topographic zone, the Major Canyons (accounting for only 4 percent of the island surface), has numerous rockshelter sites, but without much uniformity. Unfortunately, there has been no systematic survey in this zone, so site densities are not known.

5.1.1 Site Types and Categorization

A lack of (or very minimal) bioturbation makes archeological sites on San Clemente Island better preserved than those on the mainland (Raab and Yatsko 1998). Yatsko (1996) has developed a taxonomic classification of sites for CRM

that is tailored for the San Clemente Island archeological program and is based on extensive research and analysis. Yatsko's (1996) categorization includes a broad view of the range of site types and constituent elements identified for the island. His classification, based on site characteristics, has four potential avenues for categorizing sites: midden condition, predominant shell constituent, lithic constituent, and site size.

The midden condition categorization includes carbonaceous midden, deflated midden, embedded shell midden, intermediate conditions, and combined conditions. Of these five categories, the three primary types are carbonaceous, deflated, and embedded, with options for describing intermediate conditions and combined conditions. Yatsko's (1996) assumption is that these three different middens are of different chronological ages. In other words, the organically rich carbonaceous middens are the more recently deposited, and embedded deposits are the oldest. Yatsko (1996) also notes that the conditions of the middens are dependent on the topographic zone.

The predominant shell constituent categorization is applicable only to shell bearing sites; it groups sites according to shellfish species and density. Four main shellfish species are included: *Tegula* sp. (turban snail), *Haliotis* sp. (abalone), *Astraea* sp., and *Mytilus* sp.; density is largely subjective (dense, moderate, and sparse).

The lithic components categorization is applicable only to sites with lithics, and includes two broad groups of categories: artifactual and nonartifactual. Artifactual categories include flaked lithics, ground stone, and special purpose objects (both utilitarian and ceremonial artifacts). Nonartifactual lithic components in sites involve concentrations of angular unmodified or fire-altered rock (Yatsko 1996).

Yatsko's (1996) last classification uses site size. The four site categories include small (less than 15 m), medium (15–30 m), large (30–100 m) and very large (more than 100 m).

In order to facilitate comparable site typology on the mainland, five types of sites are presented here based on a review of the archeological record on the island. The five site types include residential, shell scatters, lithic scatters, rockshelters, and rock art sites. The residential sites, shell scatters, and lithic scatters have the subcategories carbonaceous, deflated, and embedded. Residential sites are habitation locales characterized by high densities of artifacts and ecofacts, anthropogenic sediments, features, perhaps burials, and varying intrasite distributions. They appear in the Coastal Terraces, Upland Marine Terraces, Sand Dunes, and Plateau. They are unlikely in the Major Canyons and the Eastern Escarpment. Shell scatters are shell-processing locations that have more limited and short term use; they are found within the Coastal Terraces and Upland Marine Terraces. Lithic scatters are lithic production loci with generally poor anthropogenic sediments; they are likely to be found across the different topographic zones, perhaps with the exception of the Coastal Terraces. Rockshelters and rock art sites are located in the Major Canyons and, possibly, in the Eastern Escarpment.

This categorization, which incorporates Yatsko's (1996) midden condition characterization and site type, can be used more effectively for research because it provides a classification more applicable to the mainland and San Nicolas Island archeological record. In addition, it contributes to management of cultural resources because it allows for tailoring of the program to evaluate and mitigate a varied set of sites with distinctive characteristics (using midden and site type). In doing so, it helps develop a better understanding of their significance potential and cultural integrity.

5.1.2 Approach

Large scale investigations on San Clemente Island have been focused on sites located on the Coastal Terrace, Upland Marine Terraces, and Plateau. Of the six topographic zones, these three together account for 82 percent of the island. There have been significantly fewer archeological investigations on the Sand Dunes and Eastern Escarpment and within the Major Canyons. This is, in part, because of the needs and locations of project development that requires CRM investigations, and because of the topographic and vegetation challenges presented by the Eastern Escarpment and Major Canyons.

Using the site type information and the site categorization, a protocol for future research is recommended that will address data gaps in the archeological record. First, highest priority should be given to completing an islandwide archeological survey and inventory of sites per modern acceptable professional standards. It should be noted that the Cultural Resources Management Program has already taken proactive measures to address this issue. Second, considerable focus should be placed on excavation of sites on the Sand Dunes and Eastern Escarpment and within the Major Canyons to allow for comparability between topographic zones on the island. Third, it is important that geomorphological studies tailored to address changing landscapes and drainage systems are conducted on the island. This is of particular relevance for reconstructing the human occupation history on the Sand Dunes, where there is a potential for buried sites (Raab and Yatsko 1998). Fourth, a concerted effort should be made to address the issue of comparability of data between San Clemente Island, other southern Channel Islands, and the mainland. This is imperative for any broad archeological studies on San Clemente Island that will consider regional data from other islands and the mainland. For example, the basic definition of what constitutes an archeological site is very distinct for San Clemente Island and not comparable to what is considered a site on San Nicolas Island and the mainland. Finally, a considerable amount of additional research is necessary on San Clemente Island before the number of individual, case-by-case undertakings can be reduced or replaced by a landscape approach.

5.2 San Nicolas Island Archeological Record

The archeological record of San Nicolas Island represents about 8,000 years of human occupation. Archeological investigations began as early as A.D. 1870, and these early investigators removed thousands of artifacts, selecting quality specimens that would later be housed in museums and private collections around the

world (Bryan 1970; Meighan and Eberhart 1953; Orr 1945; Rogers 1930, 1993; Schumacher 1877; Woodward 1940). The focus of archeological investigations on San Nicolas Island dramatically changed in the mid-twentieth century, largely because of a paradigm shift in archeology and the advent of radiocarbon dating. Focus shifted from human burials and collection of museum quality specimens to problem oriented archeological research (Schwartz and Martz 1992). For example, Reinman (1964) examined midden constituents to reconstruct maritime adaptation strategies, and Lauter (1982) analyzed diagnostic artifacts to define an Intermediate period in San Nicolas Island chronology. Rozaire (1959) analyzed woven materials from two sites and identified weaving techniques that he attributed to a Shoshonean tradition. More recently, efforts were made to systematically survey the entire island. Reinman and Lauter (1984) conducted surveys between 1983 and 1984 and identified, recorded, and mapped 358 archeological sites. To date, a total of 535 prehistoric sites have been identified and recorded (Martz 2002). Until recently, however, only 10 sites had been excavated (Schwartz and Martz 1992). All archeological site location data, site maps, and survey areas are in the San Nicolas Island Geographic Information Systems (SNIGIS).

A standardized testing program was implemented to provide a better understanding of the island's culture history; this entailed collection of subsurface data pertaining to island chronology, subsistence and settlement patterns, and cultural sequences (Martz 1994). The testing program involves the use of (1.5 by 1.5 m) index units excavated in 10-cm levels and screened through 1/8-in. mesh. The goal of the testing, or index unit, program is to sample at least 10 percent of archeological sites on San Nicolas Island (Martz 1994). As of 2005, 58 sites (11 percent) have been excavated as a result of the testing program (Martz 2005).

Collectively, island surveys, excavations, and the index unit testing program have revealed evidence of a wide range of activities, including subsistence, domestic, and ritual practices. Analysis of otoliths recovered from archeological sites suggests that San Nicolas Island was used seasonally during the middle Holocene. Islanders visited the island primarily in spring, fall, and, occasionally, summer, most likely to fish and hunt sea mammals (Martz 1994; Salls 1988; Vellanoweth and Erlandson 1999). Dietary reconstructions indicate that the exploitation of large sea mammals decreased over time, whereas fishing activities appear to have increased (Salls 1988; Vellanoweth and Erlandson 1999).

Research efforts have focused on lithic technology to some extent. For example, Clevenger (1982) examined the lithic assemblage from CA-SNI-11 and identified a simple split cobble core reduction strategy involving bipolar flaking. Rosenthal and Padon's (1995) research has revealed systematic cobble reduction strategies as well. In addition to lithic production, early islanders manufactured a diverse array of shell artifacts, including shell fishhooks and other tools, beads, and ornaments. Strudwick (1985, 1986), Maxwell et al. (2007), and others have identified tool kits likely used in the manufacture of many of these types of shell artifacts.

In addition to locally available materials, the archeological record contains exotic items that were likely imported through trade. These include obsidian, steatite, serpentine, Monterey, Cico, and Franciscan cherts, red maid (*Calandrinia* spp.) seeds, and deer bone, all of which attest to trade interactions between San Nicolas Islanders and groups occupying the other Channel Islands and mainland.

The archeological record also has evidence of prehistoric ritual and ceremonial behavior. Recent excavations at CA-SNI-25, a site occupied largely in the late Holocene, have revealed ritual activities, including burials of ritually interred dogs, features that likely reflect ceremonial feasting activities, and a rock cairn (Cannon 2006). Other aspects of ritual behavior, as well as worldviews, are reflected in the rock art at the Cave of the Whales. This sea cave, located on the southwest coast, contains depictions of dolphins, whales, and other marine wildlife islanders would likely have seen on a daily or occasional basis (Conti et al. 2000). Although considerable advances have been made in understanding the archeological record, many data gaps remain. Filling these gaps will require addressing key research issues and carefully managing San Nicolas Island's cultural resources.

5.2.1 Site Types and Categorization

Compared to those on the mainland, archeological sites on San Nicolas Island are relatively well preserved. Based on excavation data, field notes, and surface observations, Martz (2002) has classified the island's 535 prehistoric sites into seven categories: residential sites ($n = 80$, or 15 percent), camp sites ($n = 79$, or 15 percent), stone artifact manufacture and shellfish-processing locations ($n = 164$, or 30 percent), shellfish-processing sites ($n = 90$, or 17 percent), flaked stone reduction sites ($n = 100$, or 19 percent), deflated hearth features ($n = 14$, or 3 percent), and unknown ($n = 8$, or 1 percent) (Table 4). Residential sites are characterized as containing evidence of a range of activities, including subsistence, manufacturing, and other domestic or social activities. The range of activities appears more limited at camps and typically reflects short term use. Stone artifact and shellfish-processing locations contain concentrations of shellfish and lithics, but little else. Shellfish-processing sites consist almost entirely of shellfish, whereas flaked stone reduction locations typically contain battered and tested cobbles, flakes, debitage, and shatter. Deflated hearth features are isolated hearths containing ashy soil and charcoal. Considering their isolated contexts, these features are not clearly understood in terms of overall settlement and subsistence patterns. Finally, some sites are almost entirely destroyed and, consequently, are grouped in an "unknown" category.

The following discussion of site types and distributions is based on Martz's (2005) detailed review of San Nicolas Island prehistoric settlement and subsistence patterns. Forty percent of the sites, the greatest percentage, are located on the central plateau, which also contains 58 percent of all stone artifact-manufacturing and shellfish-processing locations, 29 percent of all shellfish-processing sites, 77 percent of all flaked stone reduction locations, and 75 percent of all "unknown" sites. Shellfish-processing locations are relatively abundant on

the south coast as well, whereas the majority (57 percent) of deflated hearths is located on the northern coastal terrace. Considering their orientation toward the other Channel Islands and mainland, the deflated hearths may represent signal fires used to guide canoe travelers to shore (Hudson et al. 1978).

Based on a total of 174 radiocarbon dates from previously excavated sites and index units, it appears that the greatest number ($n = 42$) of sites were occupied in the late Holocene. Types of late Holocene sites include residential ($n = 20$, or 48 percent), camp ($n = 10$, or 24 percent), stone artifact-manufacturing and shellfish-processing location ($n = 10$, or 24 percent), and shellfish-processing locales ($n = 2$, or 4 percent). Most of the sites are situated on the central plateau; however, evidence of human occupation during this time is found across the island.

A similar distribution of site types is evident for middle Holocene occupation. The majority ($n = 15$, or 68 percent) of sites are residential. These are followed in frequency by camps ($n = 3$, or 14 percent), stone artifact-manufacturing and shellfish-processing locations ($n = 3$, or 14 percent), and shellfish-processing locations ($n = 1$, or 4 percent). Some sites appear to have been occupied during the middle to late Holocene transition. In contrast to late Holocene site distribution, most ($n = 14$, or 64 percent) of the sites occupied during the middle Holocene are situated on the west end. Middle Holocene sites have also been identified on the central plateau ($n = 7$, or 32 percent) and southern coastal terrace ($n = 1$, or 14 percent). Evidence of occupation during the early Holocene is limited. Three sites have been identified dating to this time period: CA-SNI-351, located on the central plateau; CA-SNI-339, situated on the southern coastal terrace; and CA-SNI-11, located on the northwest coast. Other sites were likely occupied during this time, but may have been submerged as a result of rising sea levels. Based on extensive erosion and orientation toward the mainland, Bryan (1970) suggests that the southeast coast may contain additional evidence of earliest occupation.

As part of an islandwide prehistoric site-mapping and -recording project, Martz (2002) evaluated all sites on the island for research potential and grouped them into six categories. Therefore, no new categorization is done in this project; instead, Martz's (2002) work is very briefly summarized. An archeological site on the island was defined as continuous surface distributions with a break of 30 m or more between distributions. Martz (2002) used six criteria to rank the sites into six categories: I (Excellent), II (Very Good), III (Good), IV (Moderate/Marginal), V (Poor), and VI (Destroyed). The majority of the sites were in Category IV (73 percent). The six criteria include possibility of uniqueness of site, range and extent of surface materials, depth of deposits (where it can be determined), kind and number of site units within the site, condition of the site, and potential for destruction (Martz 2002). The six category classification is very helpful in site management, and determining the approach to site protection and prioritizing research on the island.

Table 4. San Nicolas Island site types.

Site Type	Count	Percentage
Residential	80	15
Camp	79	15
Stone artifact manufacture and shellfish processing	164	30
Shellfish-processing	90	17
Flaked stone reduction	100	19
Deflated hearth feature	14	3
Unknown	8	1

5.2.2 Approach

Using the survey data, Martz (2002) also classified the 535 sites on the island into seven site types that can be used to construct models of prehistoric land use. She maintains that this classification needs to be tested in future research. The seven site types include substantial habitation, camp, lithic manufacture and shell-processing location, shell-processing location, flaked stone reduction location, deflated hearth, and destroyed site. Using the site type information and the site categorization, Martz (2002) systematically reviewed all sites on the island and recommended a tailored management protocol. For example, high priority for evaluation should be given to sites with early and middle Holocene occupations and sites that are prone to impact from sea mammals. Given that Martz (2002) provides an in-depth and succinct discussion of determinations of NRHP eligibility on the island, there will be no further discussion here about the approach and methods. A considerable amount of additional research is necessary on San Nicolas Island before the number of individual, case-by-case undertakings can be reduced or replaced by a landscape approach.

5.3 Sandy and Lagoonal Mainland Coast and Mainland Inland Highland Archeological Record

Two landscapes, the sandy and lagoonal mainland coast and mainland inland highland, are represented by Camp Pendleton in this study and are discussed together in this chapter. Camp Pendleton has been the venue of archeological research for more than 60 years and has an archeological record that represents at least 6,000 years of human occupation, from the early Holocene extending into the Ethnohistoric period. Systematic research started in the 1960s and primarily involved archeological surveys by San Diego State University (Bull 1975; Waldron 1978) and other, more limited excavations (Chace 1975; Ezell 1975; Hines 1991). Archeological research on the base burgeoned in the 1980s, and, to date, there have been well over 50 archeological surveys. Ninety eight percent of non-live fire areas have been surveyed (Stanley Berryman, personal communication 2007). The archeological surveys have also included surveys of burn areas, which provide significantly higher ground visibility and enhance the reliability of the survey results; in some cases, they have also applied groundcover clearance programs to increase the reliability quotient (see, e.g., Reddy 1998).

A total of 570 sites have been recorded on the base, of which 251 sites (44 percent) have been tested (Stanley Berryman, personal communication 2007). The testing has included a wide range of sites located in the sandy and lagoonal coastal and inland highland landscapes. A unique and important aspect of the corpus of sites tested on the base is that they include low density sites of various sizes and types and larger high to moderate density sites with complex depositional histories in varied ecological settings (coastal drainages, coastal terraces, inland drainages, and inland highlands). There has been a concerted effort by the Cultural Resources Management Program to investigate a wide range of sites, and this has contributed significantly to our understanding of land use within and between landscapes. A few examples of recent excavations at small to moderate sized sites include the work done along the coast by Byrd (2003), Hale and Becker (2005), Reddy (1999, 2004), York (2003), and York and Shaver (2004); at inland sites by Hale and Becker (2005), Reddy (2000), and Shaver and York (2003, 2005); and in the inland highlands by Byrd (1999); Reddy (2000), and Shaver and York (2004, 2005).

Archeological research on the base has involved a wide range of studies, including in depth geomorphological reconstructions of the paleocoastline, ancient lagoons, and the changing coastal landscape, particularly around Red Beach and Ysidora Flats in central and southern Camp Pendleton (Waters 1996a, 1996b; Pope 2005). Pearl and Waters (1999) mapped 16 drainages on the base showing the Pleistocene terraces and Holocene alluvial deposits; such delineation of deposits can be used to model for buried archeological sites. Innovative approaches to buried site archeology have been applied in the coastal setting of the base in Red Beach (Byrd 2003; Hale and Becker 2005; Reddy 2004) and Santa Margarita River/Ysidora Flats (Byrd 2005). Micromorphological analysis of sediments from coastal sites on the base has been conducted since the mid-1990s (Byrd 1996a, 2003; Goldberg and Byrd 1999; Reddy 2004). Lithic use-wear studies have been applied more recently to a small group of sites (Hale and Becker 2005). Systematic and rigorous paleoethnobotanical studies have been conducted at coastal and inland sites (Byrd 1996a, 2003; Reddy 1997a, 2000, 2004; York et al. 2002).

Archeological surveys and excavations have revealed temporal trends and spatial patterns related to subsistence systems, settlement patterns, and site function. Models have varied from long term coastal occupation to seasonal coastal camping and from seasonal inland camps to long term residential bases. Dietary reconstructions indicate that the exploitation of fish increased over time (Wake 1999), acorn use was minimal (Reddy 1999), and small package shellfish were intensively exploited on the coast after 3000 B.P. (Byrd 1998; Byrd and Reddy 2002; Reddy 1999). A local chert source, Piedra de Lumbre, located on Camp Pendleton, was quarried for immediate local use, but also for trade to other regions within San Diego County. Archeological investigations at ethnohistoric village sites (Hale and Becker 2005; York et al. 2002; Woodman 1996b) has yielded important information about the transition between the Late Prehistoric period and the Mission period in the area.

In the past few decades, radiocarbon dating of archeological contexts on the base has increased significantly; this facilitates modeling of temporal trends based on absolute dating. The base has compiled a total of 215 radiocarbon dates from 70 sites (Steve Harvey, personal communication 2007). Three major temporal trends are emerging:

- The majority of the human occupation of the coast was in the late Holocene (1650 cal B.C.– cal A.D. 1700).
- Coastal occupation increased dramatically starting about A.D. 50.
- There is no evidence of occupation in the inland highland areas before A.D. 900.

There is evidence of early Holocene (7000–5600 cal B.C.) occupation on Camp Pendleton from a range of sites, with the earliest date being 6700 cal B.C. from CA-SDI-12628, located within the Santa Margarita River lower drainage system and less than 4.8 km from the coastline (Table 5). There are at least five early Holocene sites on the base located on the coastal terraces (CA-SDI-10728 Locus A, CA-SDI-10723) and along the Santa Margarita River system (CA-SDI-4416 and CA-SDI-10156 Locus A) (within 6 km of the coastline). Middle Holocene occupation of the coastal landscapes of Camp Pendleton is represented at six sites; the majority of the sites are dated to the late Holocene. Examining the trend by cultural period, early Archaic period occupation was higher compared to the middle Archaic period. Furthermore, early and late Archaic period occupations appear to be more comparable. Prehistoric occupation of the coast and inland burgeoned in the Late Prehistoric period. This radiocarbon dating data supports Byrd (1998) and Byrd and Reddy's (1999, 2002) settlement pattern model for the late Holocene coastal landscape on Camp Pendleton. This model suggests that there is a diachronic trajectory beginning in A.D. 700 that involves an increase in site density and an increase in the types of specialized sites and residential bases. This pattern was interpreted as the emergence of a complex settlement pattern with major residential bases along key drainages and more specialized sites clustered around them.

In addition to the surveys and excavations, there have been several basewide reviews and research designs completed for Camp Pendleton. These include an evaluation of archeological surveys by Byrd (1996b), assessment of archeological testing projects on the base by Reddy (1997b), a research design for archeological study by Reddy and Byrd (1997), an integrated CRM plan by Berryman and Reddy (2000), and an archeological research context for the lower Santa Margarita River by York (2005).

Perhaps one of the most important and valuable undertakings by the base is the compilation of the Camp Pendleton Geographic Information System (CPAG). The CPAG was first constructed in 1995–1996, but is a dynamic platform that accommodates the constantly changing nature of archeological research. It is composed of data on archeological survey areas and site locations, with a large, associated database (over 70 variables) that allows the user to construct customized and uncustomized queries for management and research (see, e.g., Brewster et al. 2003; Reddy and Brewster 1999).

Table 5. Distribution of sites, by age and location.

Chronological Period, by Time Scale	Time Range (Calibrated)	Examples of Sites on the Coastal Landscape (in Order of Age) ^a	Examples of Sites on the Inland Highlands Landscape ^a
Geological			
Early Holocene	7000–5600 B.C.	CA-SDI-12568; CA-SDI-10723; CA-SDI-10728 Locus A; CA-SDI-4416; CA-SDI-10156 Locus A	none
Middle Holocene	5600–1650 B.C.	CA-SDI-811; CA-SDI-12577; CA-SDI-10726 Locus B; CA-SDI-12628; CA-SDI-13986; CA-SDI-13325	none
Late Holocene	1650 B.C.–A.D. 1700	CA-SDI-13325; CA-SDI-811; CA-SDI-14522; CA-SDI-4417; CA-SDI-12572; CA-SDI-14748 (and many more)	many
Cultural			
Archaic period	7000 B.C.–A.D. 650	CA-SDI-12568; CA-SDI-10723; CA-SDI-10728 Locus A; CA-SDI-4416; CA-SDI-10156 Locus A; CA-SDI-811; CA-SDI-12577; CA-SDI-10726 Locus B; CA-SDI-12628; CA-SDI-13986; CA-SDI-4417; CA-SDI-13325; CA-SDI-14522; CA-SDI-12572; CA-SDI-14748	none
Early Archaic	7000–4050 B.C.	CA-SDI-12568; CA-SDI-10723; CA-SDI-10728 Locus A; CA-SDI-4416; CA-SDI-10156 Locus A; CA-SDI-811; CA-SDI-12577; CA-SDI-10726 Locus B; CA-SDI-12628; CA-SDI-13986	none
Middle Archaic	4050–1550 B.C.	CA-SDI-4417; CA-SDI-13325; CA-SDI-811; CA-SDI-4416	none
Late Archaic	1550 B.C.–A.D. 650	CA-SDI-13325; CA-SDI-811; CA-SDI-14522; CA-SDI-4417; CA-SDI-12572; CA-SDI-14748	none
Late Prehistoric	A.D. 650–1700	many	many

^a From Hale and Becker (2006), Byrd and Reddy (2002), Reddy (1997,2000,2005), and York (2005).

5.3.1 Site Types and Categorization

In comparison to the islands, archeological sites on the mainland have varying degrees of disturbance (modern and natural). Based on the excavation data, the 570 prehistoric sites on the base have been classified into 13 prehistoric site type categories (per the CPAG): habitation/village site, camp, shell middens without artifacts, shell middens with artifacts, artifact middens, shell scatters, lithic and

shell scatters, lithic scatters, milling camps with no artifacts, milling camps with artifacts, milling camps with shell, milling camps with shell and artifacts, and rock art sites. Habitation/village sites have high densities of artifacts and ecofacts, features and, possibly, burials. They are associated with organically rich midden sediment with strong evidence for a wide range of activities. These sites typically have ethnohistoric components and are often in known locations. Camps are residential habitation sites characterized by a range of activities. They represent shorter term use and have high artifact densities, with features and anthropogenic sediments. They have varying intrasite distributions and are found across all landscapes. Shell middens (dinner camps) with artifacts appear to be more limited and reflect short term use; they are similar to shell middens without artifacts, and both these site types are found within the coastal landscape. Artifact middens are rare on the coastal landscape and typically appear in the mainland inland highlands; they are similar to shell middens, reflecting short term (but intensive) use. Shell scatters are locales of limited activity. They typically have a single shellfish dominating the assemblage and a complete absence of artifacts. Shell scatters (limited activity locales) are typically located within 4 km of the coastline. Lithic and shell scatters are typically lithic manufacture/maintenance and shellfish-processing locations characterized by low densities and poor anthropogenic sediments. The four milling site types (milling camps with no artifacts, milling camps with artifacts, milling camps with shell, and milling camps with shell and artifacts) are found in the mainland inland highlands landscape.

Camp Pendleton has a basewide site categorization system based on cultural integrity and research potential for management purposes. This was developed as part of the CPAG and has been in operation since 1995. The base categorizes each site as either NRHP listed, eligible, potentially eligible, indeterminate, ineligible, potentially ineligible, or destroyed (location unknown). The majority of the sites are in the indeterminate category (61 percent). The criteria used that have not been tested include the potential for additional data that significantly contributes to our understanding of the past, the range and extent of surface materials, the depth of deposits, and the condition and cultural integrity of the site. The seven category approach is very helpful in managing resources, determining the approach for their evaluation and protection, and prioritizing research on the island.

5.3.2 Approach

A wide range of landscapes is represented in the corpus of tested sites on Camp Pendleton, from the coastal settings to the inland highlands. However, particular niches have a great frequency of tested sites. For example, compared to the inland highlands, the coastal area, in general, has been more heavily tested. Project development requiring CRM investigations has been biased toward the coastal landscapes and away from the inland area, where, in general, less ground disturbance has occurred. This is a reflection of the heavy use of the coastal areas by the marines of Camp Pendleton. Similarly, particular drainages, such as Las Flores and Santa Margarita River, have been subject to greater in-depth studies. The coastal landscape of these two drainages has witnessed rigorous archeological research through multidisciplinary approaches (e.g., Byrd 1996a, 2003, 2004, 2005; Reddy

1999, 2004, 2005; York 2003, 2005; York et al. 1999, 2002). However, San Mateo, San Onofre, Horno Canyon, Aliso Canyon, and French Canyon drainages have seen a significantly smaller amount of research (yet see Byrd 1996a; Byrd et al. 1995, Reddy et al. 1996; York and Shaver 2004).

Using established site type information and site categorization, a protocol for future research is recommended that will address data gaps in the archeological record. First priority should be given to sites with early and middle Holocene occupations on the rocky coast and inland highland landscapes—in other words, sites with potential for early Archaic and middle Archaic cultural occupations in all landscapes. This is particularly important for the inland highlands, where no Archaic occupations have been defined. The second priority should be on sites located within the inland highlands landscape. In general, there is ample data on coastal occupation and a dearth of information on the inland adaptations on Camp Pendleton. As a third priority, considerable focus should now be placed on reconstructing the paleoenvironments of San Mateo, San Onofre, Horno Canyon, Aliso Canyon, and French Canyon drainages, using the research done for Las Flores and Santa Margarita River as models. Fourth, radiocarbon dating should be applied to materials from small sites with limited midden development and low artifact and ecofact densities because these sites play an important role in the land use within a landscape and provide invaluable information, as shown by the small site archeological research done on coastal Camp Pendleton by Reddy (1999). Finally, there has to be a concerted effort to implement a standardized method of reporting radiocarbon dating, and use of calibrated dates should be the norm. This can be a challenge, but it is a very critical aspect of regionalizing archeological research.

In the move away from site specific archeology and toward landscape archeology (in which individual sites are not as important), the archeological record within particular landscapes on Camp Pendleton has been adequately established to allow such an approach. This is particularly true for the coastal areas. Thus, there is potential for discussion of coastal land use within the Red Beach landscape, the Santa Margarita River/Ysidora Flats landscape, and the Santa Margarita River upper valley. Contiguous land use has already been demonstrated at CA-SDI-811, where site boundaries are difficult to ascertain, given the dynamic landscape (see Reddy 2005). In the inland highlands, there is ample data on the Case Spring, San Mateo Canyon, and Piedra de Lumbre landscapes for researchers to delve beyond site archeology.

Given the relatively comprehensive data from the Red Beach area coastal landscape on Camp Pendleton, it is now possible for the Cultural Resources Management Program to move toward a landscape approach and decrease individual, case-by-case undertakings by focusing efforts on small and large early and middle Holocene sites. The late Holocene data set from the Red Beach landscape is adequate for both large and small sites. More data from small sites in the Santa Margarita/Ysidora Flats area is needed before individual undertakings can be limited.

5.4 Rocky Mainland Coast Archeological Record

The rocky mainland coast landscape is represented by Naval Base Point Loma in San Diego County. The base includes the National Park Service's Cabrillo National Monument and the Fort Rosecrans National Cemetery. Traditionally, the focus of archeological investigations has been historical archeology, particularly Spanish discovery and the Spanish fort, Yankee whalers, and U.S. military reservation periods (Moriarty 1977). Around 20 prehistoric sites are located on the base, of which two sites (CA-SDI-48 and CA-SDI-12953) are NRHP eligible (see Figure 12 for site locations). These two eligible archeological sites have been mitigated under Section 106 of the NHPA.*

There is a record of human occupation on Point Loma from 5000 cal B.P. The most well known research has been done at CA-SDI-48 (Gallegos and Kyle 1998), which is located on the bay side of Point Loma and dated to the middle Holocene (5000 cal B.P.). A second site, CA-SDI-10945, also on the bay side, had occupation dating to 2000 cal B.P. (Pignuolo et al. 1991). Both these sites were characterized by a maritime subsistence system (Noah 1998). There is a potential Native American flexed burial, discovered in Fort Rosecrans during road grading (Moriarty 1977), estimated to date to the middle Holocene, based on associated cultural materials (shell fragments, a modified hand stone, and fragments of a large slab grinding stone). According to Overton (1986), the human remains were left in place. Hudson (1976) found a small sandstone bowl mortar and a spherical stone artifact in 15.2 m (50 ft) of water due west of Old Point Loma Lighthouse; he recorded it as CA-SDI-8669.

In general, systematic archeological survey of the Point Loma landscape has been limited. Recently, an archeological survey by Mooney and Associates (1999) along a segment of Gatchell Road leading to the city water facility resulted in the recording of 10 sites including two historic World War II features (search light and Battery Point Loma). The eight prehistoric sites were small shell scatters with no associated artifacts. Test excavations were conducted at CA-SDI-11935, CA-SDI-11936H, and CA-SDI-11937/H (Reddy 2000d) (see Figure 12). CA-SDI-11935 and CA-SDI-11937/H were not recommended as eligible for listing in the NRHP, whereas CA-SDI-11936H was recommended as eligible.

5.4.1 Site Types

Based on the limited archeological inventory on NB Point Loma, four prehistoric site types are established, including residential camps, shell middens with artifacts, shell scatters, and lithic and shell scatters. Residential camps are characterized by high densities of artifacts and ecofacts, anthropogenic sediments, features, and varying intrasite distributions, and may appear predominantly on the bay side of Point Loma. Shell middens with artifacts are more limited and reflect short term use. Shell scatters are locales of limited activity and typically have a single shellfish dominating the assemblage and a complete absence of artifacts. Lithic

* <https://www.denix.osd.mil/denix/Public/News/Earthday98/Awards/Navyed/loma.html>

and shell scatters are typically lithic manufacture/maintenance and shellfish-processing locations characterized by low densities and poor anthropogenic sediments. This site type categorization can be applied to any rocky coast landscape.

5.4.2 Categorization

Categorization of the NB Point Loma archeological sites can be relatively simple, given the small database. The basis of the categorization is cultural integrity and research potential. The sites can be placed into five categories: NRHP listed, eligible, indeterminate, ineligible, and destroyed. Criteria that can be used to rank the sites that have not been tested include potential for additional data that significantly contributes to our understanding of the past, range and extent of surface materials, depth of deposits, and condition and cultural integrity of the site. For example, CA-SDI-48 and CA-SDI-10945 are eligible sites; the untested shell scatters are indeterminate.

5.4.3 Approach

Archeological investigation on Point Loma is still in its infancy, and there is a need for a systematic archeological survey of the entire landscape. The focus of significant study has been on the large residential camps located on the bay side; consequently, our understanding of prehistoric land use is very biased. Highest priority should be given to conducting a thorough archeological survey. As a second priority, small sites (shell middens and shell scatters) should be evaluated to gain a better understanding of how the prehistoric populations utilized the landscape. Once the archeological record is comprehensive across the landscape, then the site characteristics and types can be determined based on reliable data. Given the lack of data on Point Loma, it is premature to move beyond case-by-case undertakings.

5.5 Summary and Discussion

A necessary goal of the study was to identify and evaluate a variety of classes of archeological sites that characterize the landscapes in the SDSSCAR, primarily to decrease the number of individual, case-by-case undertakings. The discussion above presented the archeological records and site types and categorizations for the four landscapes (islands, sandy and lagoonal mainland coast, rocky mainland coast, and mainland inland highlands). In reviewing the records, it was determined that, with the exception of the rigorously investigated Red Beach area on coastal Camp Pendleton, individual undertakings cannot be replaced by a landscape approach as yet without considerable additional research.

In addition, it has also become evident that given the high variation in topography, geology, paleoenvironment, ecology, vegetation, postdepositional histories, human occupational histories, and basic archeological assumptions, it is not possible to tailor a research design that crosscuts the landscapes (and installations) represented in the SDSSCAR. The primary reasons why an integrated research design is not viable at this time are differences in site density and type across the landscapes and varying definitions of what constitutes an archeological “site.”

The definition of an archeological site is very different between the islands and the mainland. On the southern California mainland, a site is defined as three or more artifacts within a 25 m² area with 50 m separating artifact concentrations. On San Nicolas Island, an archeological site is defined as continuous surface distributions with a break of 30 m or more between distributions (Martz 2002). On San Clemente Island “A site is a discrete and potentially interpretable locus of cultural materials, where ‘discrete’ means spatially bounded by at least relative changes in material densities, ‘interpretable’ means the presence of material densities of a quality and quantity sufficient to attempt and sustain inferences about behavior, and ‘materials’ mean artifacts, ecofacts and features” (Yatsko 1986). The San Nicolas Island and southern California mainland definitions are broadly similar; however, the definition of a site on San Clemente is much more qualitative. Therefore, data from archeological surveys (i.e., number of sites) in these different landscapes/installations are not comparable.

Site density is significantly higher for the islands relative to the mainland; for example, San Clemente has approximately 23 sites per km² (3,400 sites in a 148.5 km² area). Site densities at San Nicolas Island (10 sites per km²; 535 sites in a 54 km² area) and Camp Pendleton, including coastal and inland landscapes (1.1 sites per km²; 570 sites in a 518 km² area), are much lower. This pattern in site density would be meaningful if the definition of what constitutes a “site” was comparable between San Clemente Island, San Nicolas Island, and the mainland. Sites on San Clemente Island are often what are considered specific activity areas on the mainland and San Nicolas Island, and often these “activity areas” are viewed as loci within a site. Therefore, if a site definition similar to that used on San Clemente Island is used for the mainland and San Nicolas Island, the site densities are likely to be much higher. However, this is not a measurable difference at this time.

The categorization of sites is very different between the islands, and also as compared to the mainland (Table 6). Camp Pendleton has delineated 11 site types and seven categories for management (NRHP listed, eligible, potentially eligible, ineligible, potentially ineligible, indeterminate, and destroyed). San Nicolas has seven different site types for archeological research and six categories for management (I, II, III, IV, V, and VI). San Clemente Island has 11 site categories that are research driven with potential for management.

In conclusion, a regional research design that would encompass San Clemente Island, San Nicolas Island and coastal southern California is not a feasible endeavor given the current data. The landscapes represented within the SDSSCAR are too different, and have very distinct occupational histories. Nonetheless, the research questions presented in this document overlap the landscapes to address the history and nature of human occupation through time and space at a broad level. However, approaches to the archeological record(s) cannot be standardized between the two islands and the southern coastal mainland. It is conceivable that a single regional research design can be constructed for San Nicolas and San Clemente Island, but only if and when sites are defined similarly on the two islands.

Table 6. Site types, by installation, on San Nicolas Island, San Clemente Island, and Camp Pendleton.

Site Type, by Installation	Description
<i>San Nicolas Island^a</i>	
Residential	Evidence of a wide range of activities.
Camp	Range of activities more limited; short term use.
Lithic manufacture and shell-processing location	Concentrations of shellfish and lithics only.
Shell-processing location	Concentration of shellfish only.
Flaked stone reduction location	Concentration of battered and tested cobbles, flakes, debitage, and shatter.
Deflated hearth	Isolated hearths with ashy sediment and charcoal.
Destroyed	Destroyed.
<i>San Clemente Island</i>	
Residential, carbonaceous	High densities of artifacts and ecofacts, features, and, perhaps, burials; organically rich midden sediment.
Residential, deflated	High densities of artifacts and ecofacts, features, and, perhaps, burials; deflated midden.
Residential, embedded	High densities of artifacts and ecofacts, features, and, perhaps, burials; embedded sediment.
Shell scatter, carbonaceous	Shell processing locations, short term use, organically rich midden sediment. May be homogenous or heterogeneous in terms of taxa represented.
Shell scatter, deflated	Shell processing locations, short term use, deflated midden. May be homogenous or heterogeneous in terms of taxa represented.
Shell scatter, embedded	Shell processing locations, short term use, embedded sediment. May be homogenous or heterogeneous in terms of taxa represented.
Lithic scatter, carbonaceous	Lithic production loci with tested cobbles, cores, flakes, and debitage; organically rich midden sediment.
Lithic scatter, deflated	Lithic production loci with tested cobbles, cores, flakes, and debitage; deflated midden.
Lithic scatter, embedded	Lithic production loci with tested cobbles, cores, flakes, and debitage; embedded sediment.
Rock shelter	Rock shelters with evidence of human occupation.
Rock art	Sites with rock art.
<i>Camp Pendleton^b</i>	
Habitation/village	High densities of artifacts and ecofacts, features, and, perhaps, burials; organically rich midden sediment and evidence of a wide range of activities.
Camp	Range of activities represented, short term use, high densities, features, anthropogenic sediments.
Shell midden with artifacts	High densities of shell in anthropogenic sediment with associated vertebrates and artifacts.
Shell midden without artifacts	High densities of shell in anthropogenic sediment with associated vertebrates, but no artifacts.

Site Type, by Installation	Description
Artifact midden	Artifacts in relatively moderate to high densities associated with faunal remains in anthropogenic sediments.
Shell scatter	Concentrations of shell with sediments ranging from poor and noncarbonaceous to moderately anthropogenic in character. May be homogenous or heterogeneous in terms of taxa represented.
Lithic and shell scatter	Concentrations of tested cobbles, cores, flakes, and debitage with moderate quantities of shell. Sediments range from poor and noncarbonaceous to moderately anthropogenic in character.
Lithic scatters	Concentrations of tested cobbles, cores, flakes, and debitage, typically with poor, noncarbonaceous sediment.
Milling camp with artifacts	Bedrock milling, artifacts, anthropogenic sediment.
Milling camp without artifacts	Bedrock milling features with no artifacts or ecofacts, absence of anthropogenic sediments.
Milling camp with shell	Bedrock milling features and shell, moderate anthropogenic sediments.
Milling camp with shell and artifacts	Bedrock milling features, shell, artifacts; typically have anthropogenic sediments.
Rock art	Sites with rock art.
^a After Martz (2002).	
^b Adapted from Yatsko (1996).	

6 Conclusions and Recommendations

This chapter presents management practices with respect to how this research design can help facilitate the development of a programmatic approach to assessing NRHP eligibility for archeological sites at a subset of Navy Region Southwest and Marine Corps installations. The interface between archeological project design (including site categorization) and research issues using a regional, thematic perspective within the SDSSCAR was presented in Chapters 4 and 5. The essential premise of this study is that a landscape approach will allow the military installations to more objectively develop their cultural CRM programs, particularly in the areas of assessing effects and determining the level of effort for NRHP eligibility.

6.1 Section 106 Process and the Landscape Approach

The NHPA of 1966, as amended, and other pertinent cultural resource preservation laws and regulations stipulate that the U.S. Marine Corps, as a Federal agency, has the responsibility to identify and preserve cultural resources, or mitigate losses, on lands under its jurisdiction. Section 106 of the NHPA requires Federal agencies to take into account the effects of their undertakings (projects), licensed or executed by the agency, on historic properties listed or eligible for listing in the NRHP.

These laws and regulations present a unique challenge in terms of research designs and plans. Research designs are intended to advance scientific knowledge while facilitating the primary mission of the military. Although challenging, these objectives do not have to be compromised for the mission and can be achieved through well designed cultural resource research programs. Under Section 106 of the NHPA, Federal agencies have to consider the effects of their projects on historic properties (districts, sites, structures, buildings, or objects) that are listed in or eligible for listing in the NRHP. Archeological sites are most commonly evaluated under eligibility criterion D, places that “have yielded, or may be likely to yield, information important in prehistory or history.” The crucial issue, then, is the concept of “importance,” and how to objectively quantify this determination—because all information could conceivably be “important.” For example, all isolated artifacts and all small sites provide some form of information about the past. Ascertaining which information is important is the key. In response to this dilemma, most agencies opt to evaluate all sites and determine their importance based on data gaps and research potential to answer questions relevant to the particular region and historic context. Historic contexts enable us to define important information and thus identify significant (i.e., NRHP eligible) archeological sites. The basis, therefore, of determining what is “important” lies with the development of a strong, well defined historic context.

The primary objective of this study has been to develop a historic context for the SDSSCAR using a landscape approach. In a landscape approach, individual sites become less important when compared to the overall cultural signature of a locality or region. Defining and analyzing a landscape for use in cultural interpretations involves deciphering the landscape within its own context of place and time, and exploring the relational data of sites within the greater cultural and geographic contexts. Cultural landscapes can be large or small, and their size and nature is defined based on archeological research, both inventory and excavation. Therefore, a certain level of understanding of the past is necessary to adequately and effectively define landscapes.

Cultural landscapes are not static: they have a time depth. In describing change over time, the historic significance of (a) particular component(s) of the landscape can be determined. For example, the historic significance of small, low density sites within the landscape can be determined using the research issues specifically defined for the cultural evolution within the particular landscape. The challenge, then, is to use a landscape approach that incorporates current research priorities and the need to preserve at least a representative sample of all classes of archeological information within the installation for future research needs. A landscape approach has the potential to facilitate standardized CRM tailored to specific environmentally distinct landscapes, move away from case-by-case undertakings, and enable installations to meet a wider variety of management and compliance needs in a streamlined and consistent manner.

6.2 Current Status and Recommended Future Approach

The main objective of this project was to initiate the development of a programmatic, regional approach to determining NRHP eligibility for the SDSSCAR. This was done by presenting an overall prehistoric context for the region (Chapter 3) and identifying and delving into research questions that have utility throughout the region (Chapter 4). These regionally important research issues provide a strong, up to date and basis for assessing the significance of archeological sites evaluated in future projects within the SDSSCAR.

However, in exploring these research domains (see research questions in Chapter 4), it was clear that certain research topics are of greater relevance in some portions of the region than in others (particularly when the main subareas—San Clemente Island, San Nicolas Island, the sandy and lagoonal mainland coast, the rocky mainland coast, and the mainland inland highland—were contrasted). The reasons for these spatial variances in the archeological record are that the SDSSCAR is very heterogeneous with respect to topography, terrain, setting, and natural resources. Thus, it is not surprising that, at different times in the past, there was a considerable divergence in cultural adaptations.

Moreover, it is apparent that the SDSSCAR was composed of a considerable number of prehistoric cultural landscapes and that further archeological investigation is necessary to fully and accurately define their precise extent and character. In some areas, such as around Red Beach on coastal Camp Pendleton, cultural

landscapes are well defined and the great utility of taking a landscape approach is readily apparent. Elsewhere, additional inventory and excavations are needed to adequately construct cultural landscapes for use within programmatic approaches to the archeological record.

It is recommended that additional work be undertaken that further advances the ultimate goal of the construction of an integrated research design that crosscuts the SDSSCAR. This would entail taking additional steps to define local landscapes while, at the same time, developing further constructs that aid standardization and comparison across the installations represented in the SDSSCAR. The goal would be a broadly similar and effective programmatic approach using regional thematic research issues, local cultural landscapes, and consistent site categorization. Such a construct will facilitate effective assessment and quantification of project effects on the different site categories within and between landscape types. The military installations can the more objectively develop their CRM programs and do so not simply based on whether a site is “eligible” or “not eligible,” but also by evaluating the role of the site within a landscape. In other words, by considering the overall “significance” of archeological sites within a landscape and not just relying on the narrow concept of “eligibility,” the well developed landscape approach will enable a military installation to do the following:

- Move away from case-by-case undertakings and adopt a programmatic approach to dealing with the effects of its undertakings on historic properties as provided in Section 106 of NHPA. For example, on the Red Beach landscape on Camp Pendleton, mitigation of individual sites can now be replaced by a landscape approach. The role of the particular site(s) within the landscape during the late Holocene can be ascertained based on our extensive knowledge of cultural land use of this particular landscape. Once this role has been established, the need for mitigation can be evaluated based on whether research issues can be addressed, representation of the site within the landscape and in the database, and effects of the project on the site. Thus, late Holocene limited activity shell scatters do not bear the same research potential as early and middle Holocene shell scatters in the Red Beach landscape.
- Be more effective in meeting its stewardship responsibilities under Section 110 of NHPA. Through a fully developed landscape approach, the installations can focus their stewardship efforts on managing each landscape as a whole rather than focusing on individual sites. For example, on San Clemente Island, a focus on geomorphological reconstruction of the Sand Dunes landscape, rather than on particular sites on the Sand Dunes topographic zone, will be more effective and aid in assessing effects of projects on buried sites. Similarly, on Camp Pendleton, efforts can be aimed toward building the archeological database for particular drainages (other than Las Flores, Santa Margarita etc., see Chapter 5).
- Integrate regional and local research issues (see research questions in Chapter 4) with efficient use of the funding to focus on particular landscapes that have higher project development needs.
- Develop a rigorous archeological record for a landscape that provides a broad view of land use through study of all site types. This would be particularly true for the islands, where considerably more research has been focused on the large, multicomponent sites than on small, single component sites.
- Protect a representative percentage of site types within a landscape for future research. The sites should be selected using a stratified random method. The

- sites should be selected from different site categories and landscapes for preservation for future research. It is important that the entire range of site categories is represented in this sample; i.e., there should not be an overt emphasis on the large, dense habitation sites.
- Be culturally sensitive to the Native American community by going beyond the individual sites and looking at how a landscape had cultural value and importance.

If implemented correctly, such an approach has the potential to facilitate dynamic and effective CRM. To fully realize the utility of the landscape approach and effectively apply a programmatic approach, there has to be a concerted effort among the military installations within the SDSSCAR to:

- Complete an adequate inventory of archeological sites in all landscapes represented on the installation. (San Nicolas Island and Camp Pendleton are the only two installations where there has been an adequate inventory of archeological sites [see Chapter 5].)
- Develop a consistent, or at least comparable, definition of what constitutes an archeological site that crosscuts installations.
- Develop a similar, consistent set of site types (using various site attributes) that also crosscuts the installations, perhaps employing categorization that integrates site function and character with management (as on San Nicolas Island).
- Define how to establish representative reserves of sites within each landscape while continuing to be responsible in stewardship as it pertains to Section 110 of the NHPA.
- Finally, an important component of this approach is a commitment by the installations to conduct a regular (perhaps every 6 years) synthesis of new excavation data, review of the criteria used for site categorization and management, and refinement of research issues.

On a final note, the research issues delineated in this study should be incorporated into the existing ICRMPs at the various installations. It would be constructive, in doing so, for management planning for the research issues to be prioritized in relationship to the military mission of specific installations. Similarly, it would be very valuable to specifically prioritize what is needed, archeologically, to achieve particular research objectives at each installation. For example, to address a research directive related to the intensified use of a particular resource within a particular environment (or landscape), a relevant data set should be available that is effective and usable. The ICRMPs should also select landscapes within each installation for further, updated, study and tailor the CRM program to implement how the components of the particular landscape(s) are to be defined. An example of such an update related to an existing ICRMP is that developed for Camp Pendleton by Reddy and Byrd (1997) almost a decade ago and a later on by Reddy (2000e). It is strongly urged that ICRMPs be updated rather than having this report appended. This would require incorporating the research questions into, for example, the Reddy and Byrd (1997) and Reddy (2000e) documents and producing a new document. The rate of archeological research within the SDSSCAR is not homogenous; therefore, it may be necessary for some of the installations, as compared to others, to do a more comprehensive update and incorporation of the research issues of this report into the existing ICRMPs.

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14. ABSTRACT This report presents the thematic landscape approach that will be taken to prepare the regional prehistoric context for the San Diego Subregion of the Southern Coast Archeological Region (SDSSCAR). The goal of this project was to research and develop a regional, archeologically based, historic context that will facilitate a programmatic approach to determining National Register of Historic Places (NRHP) eligibility for archeological sites at a subset of Navy Region Southwest and Marine Corps installations. The cultural resource research questions to be addressed by this project are those common to pre/protohistoric archeological sites of the SDSSCAR. This work identified gaps in the current body of knowledge, and serves as a foundation for addressing these deficiencies and as a resource to aid in determining NRHP significance, assessing effects, and creating innovative management/treatment plans at the regional level. The study identified and evaluated a variety of classes of archeological sites and other types of cultural resources that characterize distinct landscapes in the SDSSCAR. The outlined approach will significantly decrease the number of individual, case-by-case undertakings, facilitate a more effective management process, and contribute to a better collective understanding of the precontact (prior to A.D. 1769) Native American regional perspective.					
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